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vol. 14
#166

October 1960

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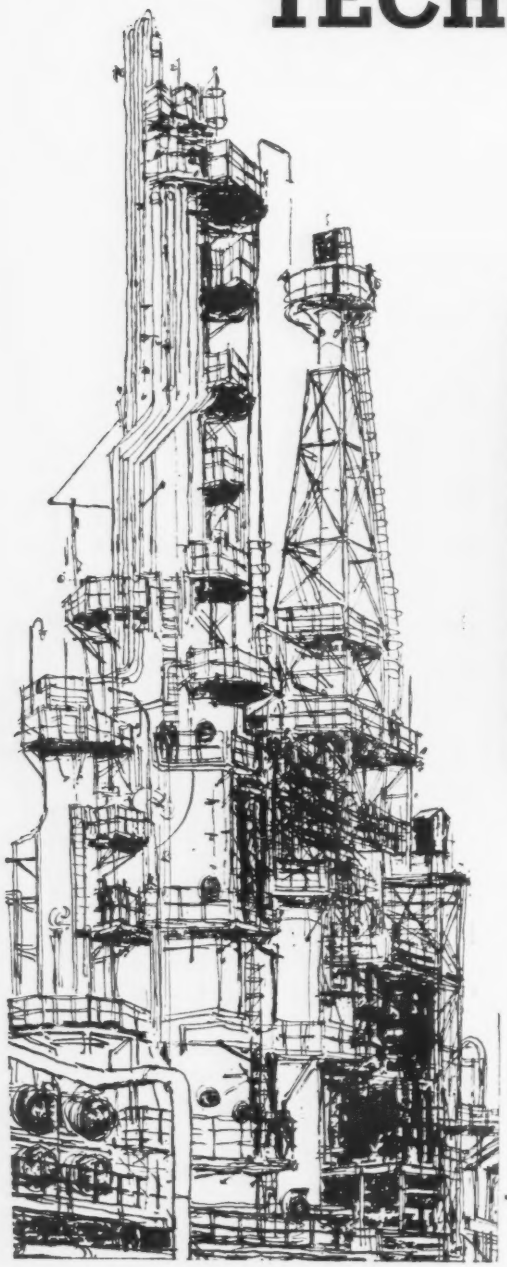

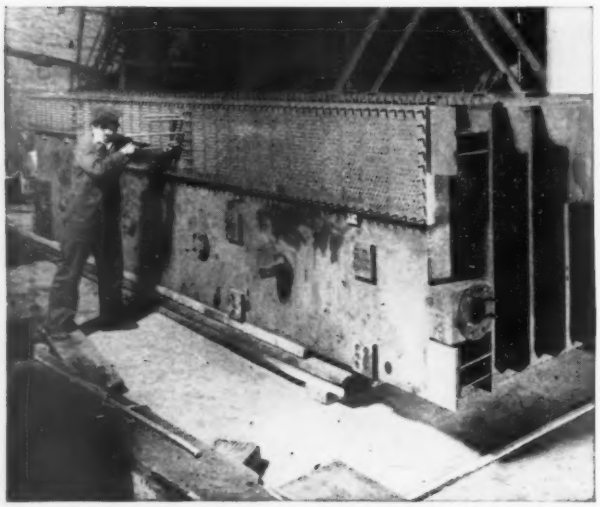

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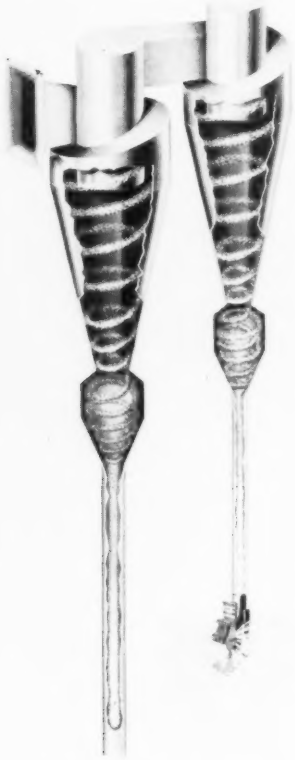

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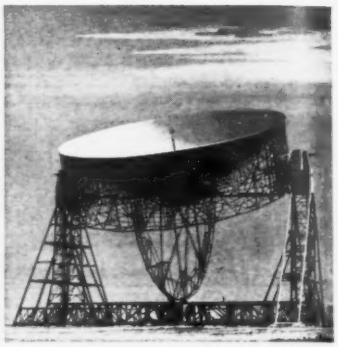
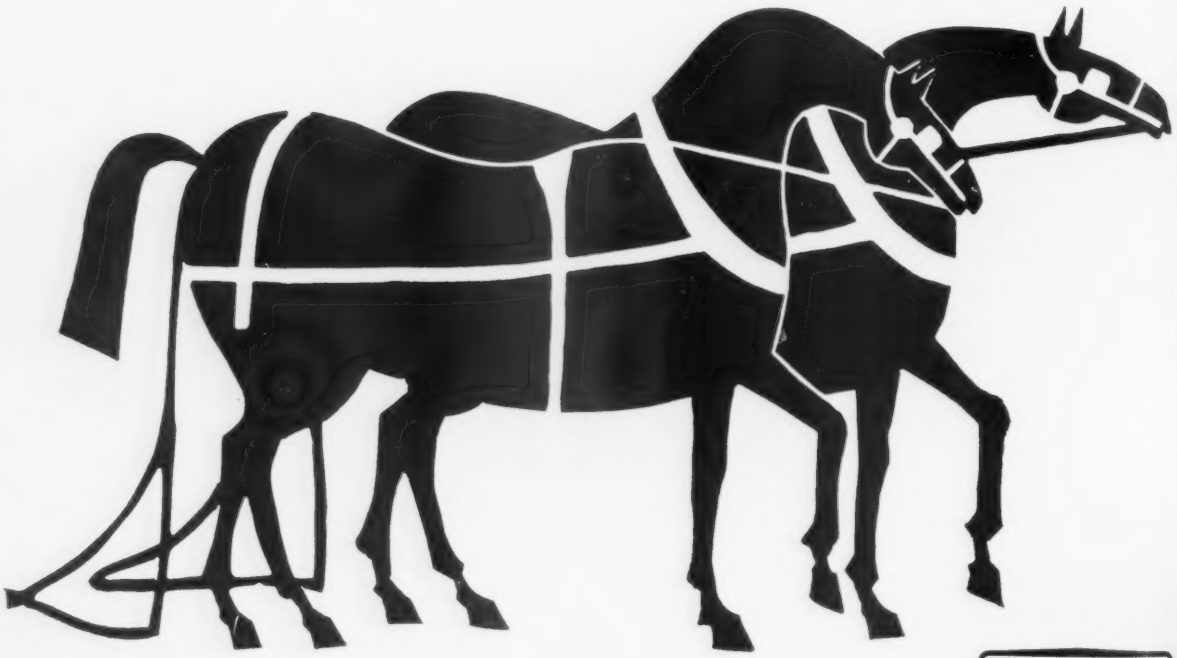


WHEREVER CHANGE MAY LEAD



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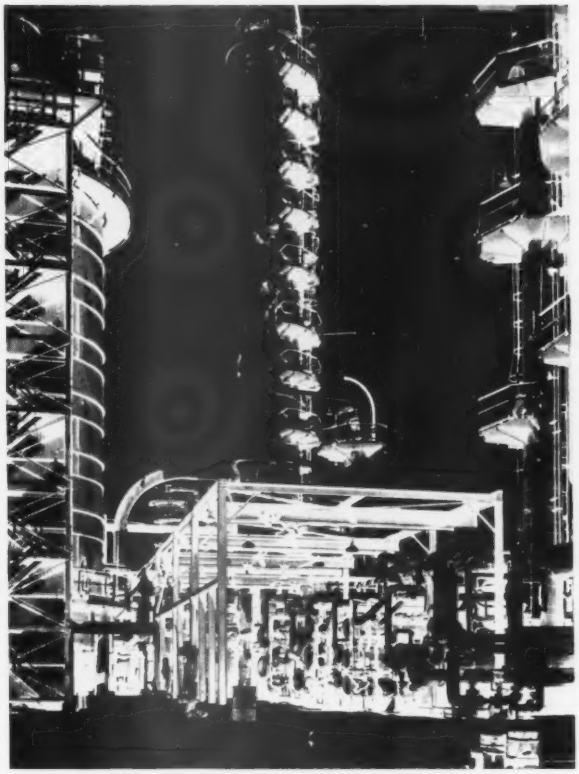

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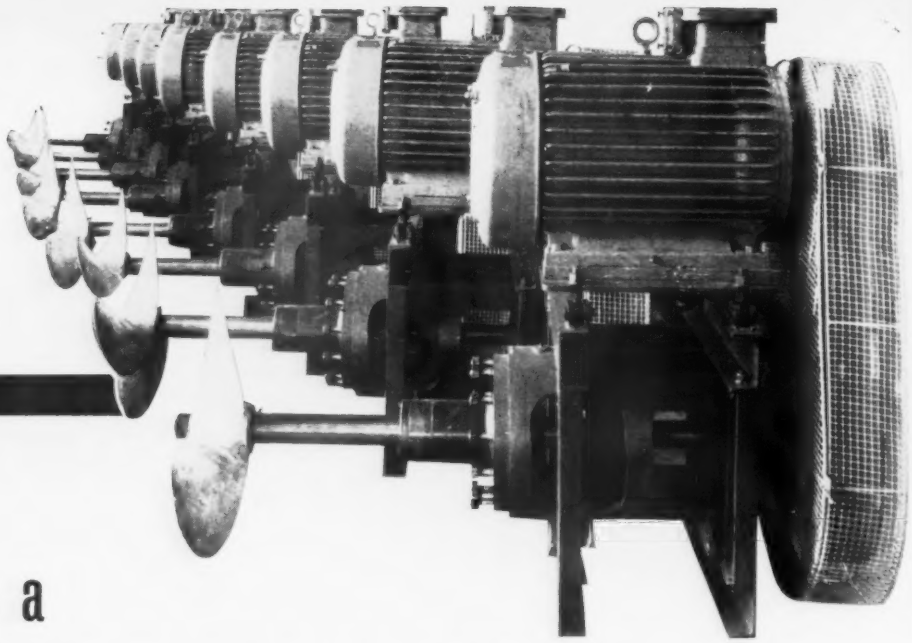

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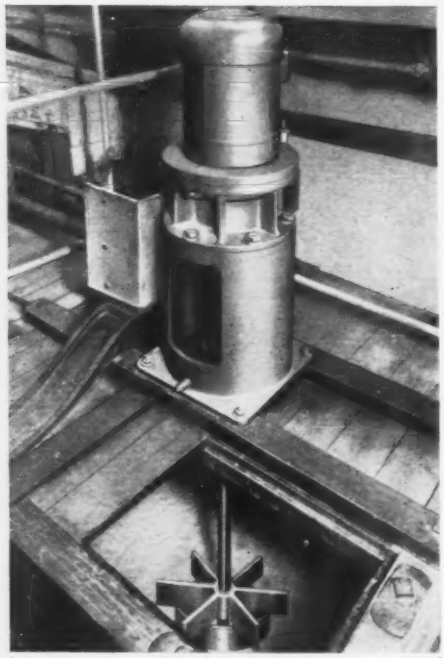
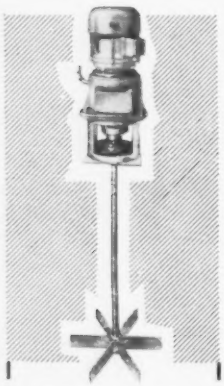
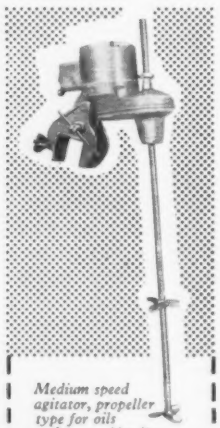


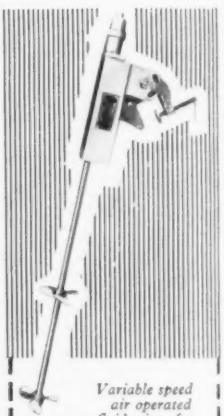
*GVD type medium speed fluid mixer fitted with open type turbine impeller and stabiliser ring for oil and grease blending and for the inclusion of additives into lubricating oils.*



*Heavy duty 460 r.p.m. permanently mounted fluid mixer with turbine impeller.*



*Medium speed agitator, propeller type for oils and grease blending.*



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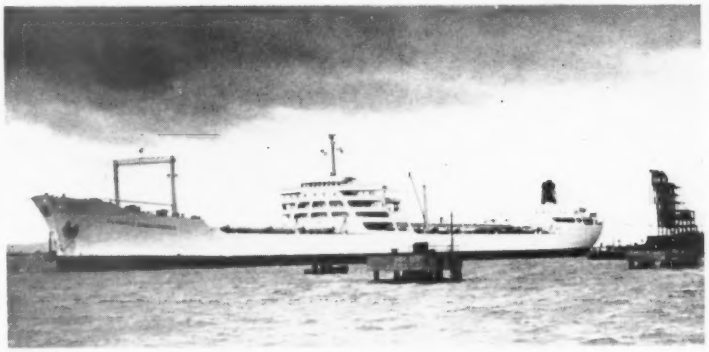

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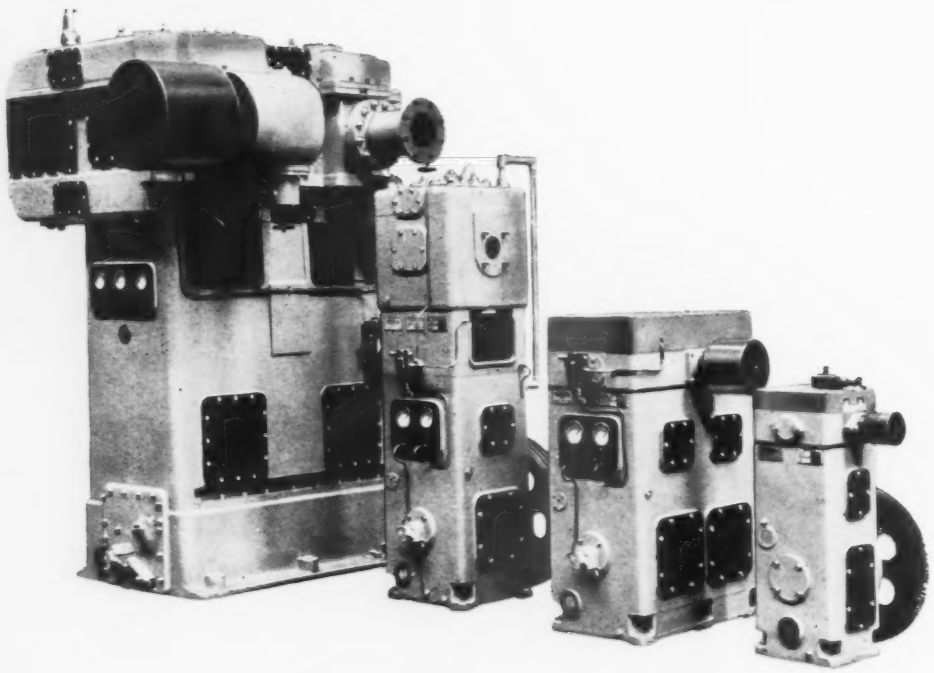

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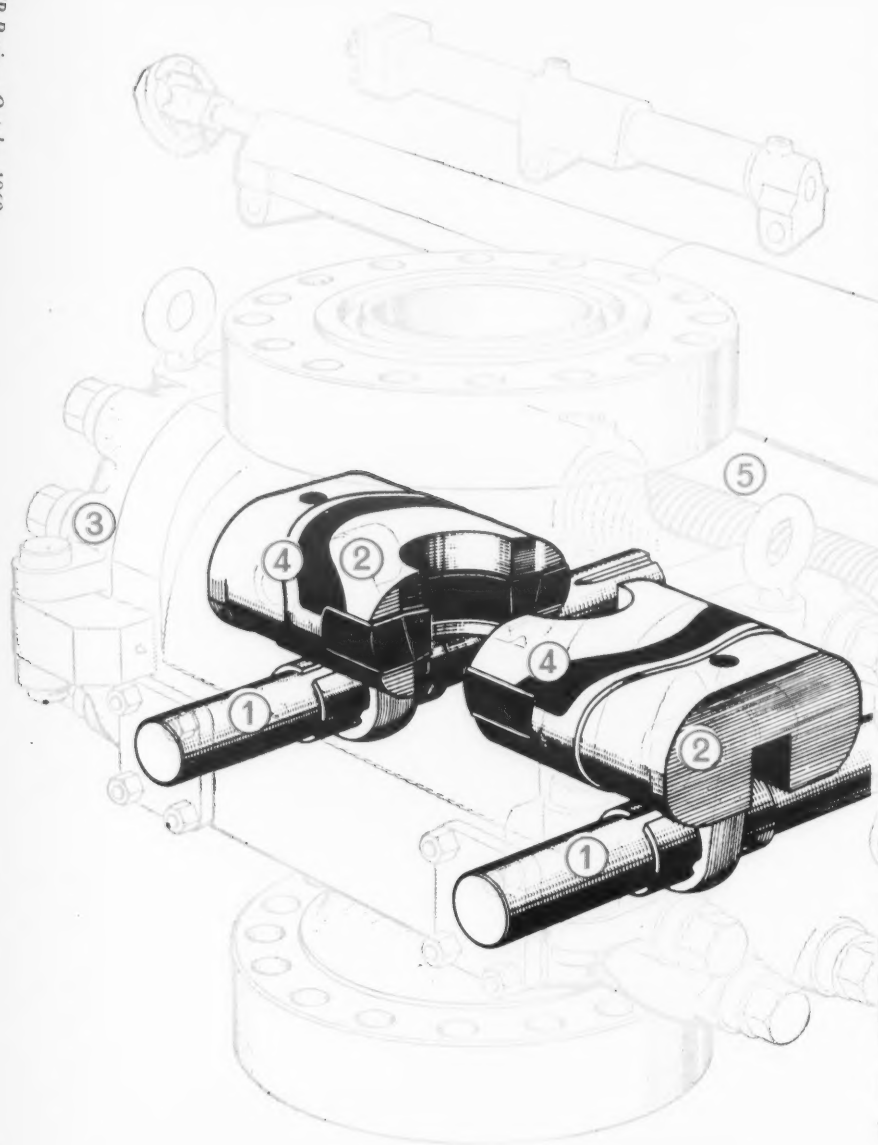


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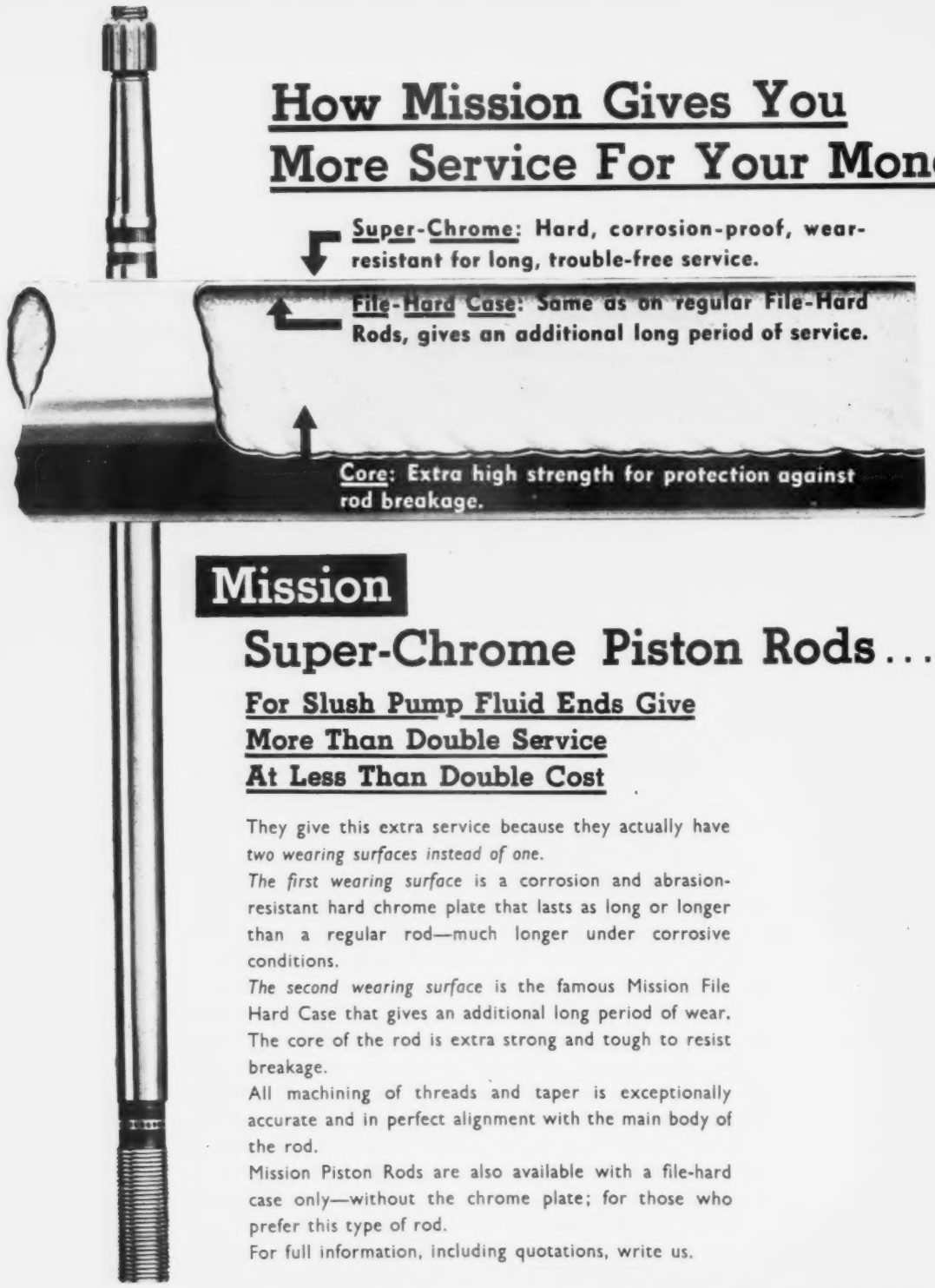
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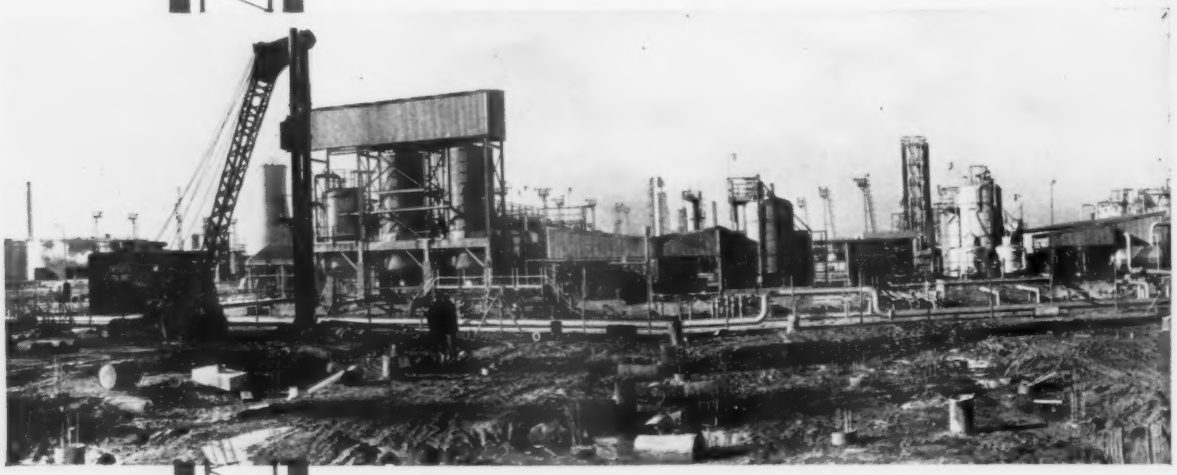

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# *The History of Trinidad Oil**

*By* DR A. L. DOWN†

More and more of the general public are beginning to know something of the oil industry, and all those who travel in the south of Trinidad, whether on land or sea, cannot but fail to be impressed by the works that they see and by the development in progress. The statistical records are most ably presented annually in the publication which has for many years been issued by one of the senior members of our Branch, namely the Government Petroleum Technologist, Mr Foster, now in his retirement year after 24 years of service. The newspepers are giving more data of the happenings in the oil industry and more statistics are being presented to the general public, but how many known anything but the vaguest details of the beginning of the petroleumn industry in Trinidad. In spite of the efforts of certain of our members now no longer with us, in particular W. F. Penny, with the assistance of the Branch and of the oil companies, there is no published history of Trinidad oil.

On the other hand much has been written about the beginnings of the oil industry in North America, and particularly concerning the doings of a gentleman by the name of Colonel Drake, although we understand that he never saw military service and the title of Colonel was merely a subterfuge given by his financial backers in order to enhance prestige. Last year saw the centenary of Drake's well at Sugar Creek, Pennsylvania, when oil was encountered at a depth of about 70 feet, and in spite of claims by other countries—Canada in particular—that date has become by usage the starting point of the history of the modern oil industry. Now what was happening in Trinidad in that year 1859? The Pitch Lake was well known, as is shown by Trinidad postage stamps. Sir Walter Raleigh caulked his ships at La Brea and no doubt the Pitch Lake was a source of wonder to the Spanish settlers, who probably considered it rather messy. Certainly it aroused the interest of General Abercromby and Lord Cochrane when the island came under British rule following its capture in 1797. They were probably responsible for the visit of Dr Nugent, an eminent member of the Geological Society, who visited Trinidad in 1807 for the expressed purpose of studying the Pitch Lake, and the account he gave to the Geological Society was published some four years later.

Little seems to have come of Dr Nugent's efforts until 1855, when arrangements were made for a geological survey of Trinidad, which was made by two gentlemen by the name of Wall and Sawkins with specific reference to the Pitch Lake. They published "A Report on the Geology of Trinidad" or "Part 1 of the West Indian Survey", in 1860, this work still being referred to by geologists even to-day. Much interest was aroused in the possibility of obtaining oil from the pitch of the lake or from formations surrounding the lake itself, and the record shows that the Merrimac Company registered in 1857 made attempts to produce oil by distillation of pitch. Furthermore, in the same year, it drilled a well to a depth of about 280 feet, which was a much greater depth than Drake's well in Pennsylvania, and two years earlier, and produced oil from it. However, in spite of its success the Merrimac Company went into liquidation. In all probability transportation was one of the major troubles, and the discovery of oil in the United States and the development of the shale oil industry in Scotland and elsewhere in the later 1850's resulted in the potential markets for Trinidad oil being supplied from sources closer to them.

However, a few years later another pioneer tried again, this time a civil engineer from the United States by the name of Walter Darwent, who interested a number of merchants in Port-of-Spain in floating the Paria Oil Company. After drilling a dry hole somewhere near San Fernando, he completed a successful well in the Aripero estate in 1866–67 at a depth of 160 feet. In the following year another venture, the Trinidad Lake Petroleum Company, drilled a successful well in the La Brea area, striking oil at 250 feet. Darwent unfortunately died soon after, and with his death interest in the oil prospects of Trinidad lay dormant until the present century, with the exception of a solitary report of a hunter bringing in a sample of oil collected from a seep near Moruga.

*Chairman's address to the IP Trinidad Branch at the Annual Dinner on 23 April 1960.

†Texaco Trinidad Inc.

At the start of the present century Randolph Rust, regarded by many as the father of the Trinidad oil industry, first appeared on the scene: and in association with Lee Lum, who owned adjacent properties in the area, the long uphill fight to develop Guayaguayare into a commercial oilfield was started in 1901 with Canadian financial backing. Until the last few years, during which time road communications have greatly improved, it was to many people quite an adventure to visit the south-east corner of Trinidad. It needs but little imagination to appreciate at least some of the practical difficulties with which Rust had to contend in getting equipment into an area such as Guayaguayare. Everything had to be towed around from Port-of-Spain on lighters, which were probably worked at high tide over the bar of the Pilot River to a roughly-prepared landing stage, from which the equipment was hauled by oxen through the bush or over rough clay roads. The drillers employed were Canadians, and three or four expatriates with a group of Trinidadians (mainly negroes from Mayaro and Guayaguayare village), starting with nothing that they had not brought in with them, and certainly with none of the general amenities of the civilized world at that time, got to work in the forests. They overcame many difficulties and ill-health, and in May 1902 the first well was commenced using the Canadian pole system of percussion drilling. Three months later the well was completed at a depth of 1015 feet, and oil was produced at the rate of 100 barrels a day.

Mr Rust persuaded the Governor, Sir George Le Hunt, to make a trip to Guayaguayare to inspect the well, and he was accompanied by the Government Inspector of Mines, no less a person than John Cadman, later Lord Cadman, who was president of the Institute of Petroleum in 1916–1917 and again in 1935–37. Eight more wells were drilled, and there are reports in the early drilling logs that in some wells rotary drilling was used at depths below 600 feet. In spite of finding a number of producing wells, the sustained effort over a period of five years had exhausted the funds. Guayaguayare was abandoned without making a commercial shipment, transportation of the oil out of the field being one of the major difficulties.

One of the results of Rust's early efforts was in interesting the Government to bring out an eminent geologist, Mr Cunningham-Craig, in 1904 to map Trinidad geology with the primary object of locating oilfields.

A third personality, as dynamic as Cadman and Cunningham-Craig, arrived in Trinidad in January 1906: A. Beeby Thompson, an engineer with experience with British oil companies in Russia. At this time the great oilfields of the Middle East and Venezuela were undiscovered, and the greater part of world oil production was divided about equally between U.S.A. and Russia.

Cunningham-Craig's surveys had directed interest to the Point Fortin region, and Beeby Thompson started building a base in this area for the Trinidad Oil Syndicate in late 1906. Conditions were unhealthy, staff and employees suffered severely from malaria, and in April 1907 there was a serious outbreak of yellow fever. Drilling, however, commenced in May 1907, and difficulties were experienced with swelling and heaving clays, in spite of which a number of shallow producers were completed in 1907 and 1908 by percussion drilling. Productivity of the field being thus demonstrated, thoughts were entertained of forming a larger company, this being at a time when the Admiralty were getting anxious to secure oil supplies under British control for the Royal Navy, whose new ships were almost entirely oil-burning. As a result Trinidad Oilfields Ltd was formed early in 1910, Beeby Thompson meanwhile having secured further acreage, including the area known as Parry Lands. In 1911–12 a number of prolific wells were drilled in this area, one flowing at 10,000 barrels a day from a depth of 1400 feet. Thus Trinidad's first commercial success was achieved, by the Trinidad Oilfields Ltd, which was taken over in 1913 by United British Oilfields of Trinidad Ltd, now Shell Trinidad Ltd.

At the same time as this development in the Point Fortin area, and encouraged no doubt by the successes of Trinidad Oilfields, others started drilling in the neighbouring areas. The Trinidad Lake Petroleum Company drilled a successful well to the south of Pitch Lake in 1909, and three years later extended their operations into Vessigny where they brought in a number of good producers. Well No 42 caught fire in October 1913 when producing oil at a rate of 30,000 barrels a day.

Owing to the pressures encountered, troubles with blow-outs were numerous, and fires occurred all too frequently. The records tell us that in 1912 a Mr Stollmeyer, drilling in his Perseverance estate near Guapo, struck oil at 250 feet, but the well blew wild and some 80,000 barrels of oil escaped down the Vance River. One can imagine the pollution problem that resulted.

With the high pressures encountered in these shallow wells, it seems to have been the generally accepted thing that gushers would be encountered. Consequently arrangements were made to salvage as much of the oil that gushed as possible; hence whilst drilling was in progress earthen dams and drains were constructed to contain the oil and since no one knew when oil was likely to be encountered, if it was encountered at all, an emergency crew was kept on hand with pumps, spades, and picks. Since some of these wells, when they did produce, made as much as 10,000 barrels a day for several days "the emergency crew had to rush around quite a bit", as one contemporary writer puts it. Invariably the wells came to a halt through sanding up or through collapse of the casing, and as much of the oil as possible was then pumped away to storage.

Some of the early drilling logs make most interesting reading, and I quote:—

> "Well blew two joints of five-inch pipe above crown block".
> "Had to close down owing to gas and rocks coming out of the hole".
> "The pressure lifted the rotary table not less than 30 feet up into the derrick".
> "Well blew five joints of eight-inch casing up into derrick bringing down travelling block and crown block".
> "Well flowed tools out of the hole followed up with oil and sand and shooting rocks out of the hole".

Mention has already been made of rotary drilling, and the first well drilled entirely by this method was Parry Lands No D-4, completed to 580 feet in April 1914.

In the years immediately preceding the first world war, a number of other companies who are with us to-day made their appearance. Among them Trinidad Leaseholds Ltd, founded in 1913, now Texaco Trinidad Inc, who brought in their first producer in Forest Reserve in April 1914, the discovery well for that field; and Trinidad Central Oilfields, formed by Alexander Duckham as a private company in 1911, with headquarters at Tabaquite.

The outbreak of the first world war saw Trinidad's oil production pass the 1 million barrel mark for the first time.

Colourful as is the early history of oil production in Trinidad, one must remember that production is only stage

one, to be followed by storage, transportation, refining, and marketing.

Early storage of crude oil in Trinidad was in underground earthen tanks. Some must have been of considerable size. Rust records 300 barrels being stored in one in the early days in Guayaguayare, and there is a report that a pony fell into one and was drowned, being unable to swim in crude oil. In 1914 a report showed 30,000 barrels of crude in earthen storage in Forest Reserve. There are few details of storage tanks prior to this time, although in 1910 six large 64,000-barrel tanks were erected at Brighton.

The first export cargo of crude oil was loaded from Brighton in 1910—Sir George Le Hunt being present on this important occasion. Later, pipelines were laid to load crude oil at Pointe-a-Pierre and Claxton Bay, the former from the Forest Reserve field and the latter the light crude from Tabaquite. Concerning Pointe-a-Pierre, there is an interesting account concerning the Admiralty tanker *Masconomo*, on the 16 August 1916. The captain went ashore and asked the manager "Have you got any oil?" The manager replied, "Not at present, but if you care to wait a day or two, we're drilling a well and we'll give you all it's got—if it gets any!" The captain decided to wait and with some of his officers made a trip to Forest Reserve to see the well brought-in. Fortunately the initial flow was sufficient to complete the cargo, and oil was pumped straight from the well into the ship, no doubt plus water and sand.

On the refinery side, the first small crude unit was established at Point Fortin about 1910, followed by another at Brighton. A number of other small crude units were built to supply local requirements of gasoline and burning oil, and in 1917 the refinery at Pointe-a-Pierre was started. Like all refineries of the period the basis was the horizontal boiler-type crude stills. The year 1922 saw the introduction of a cracking plant at Pointe-a-Pierre, rather before the days of the cracking art, as the following description would indicate—"Trees in the vicinity of the plant when it was in operation exhibited glorious autumn tints as a preliminary to dying, birds passed away in the atmosphere of hydrocarbon vapours and hydrogen sulphide, silverware turned black with prolific deposits of silver sulphide, and the whole neighbourhood was rendered uninhabitable". After a few experimental runs the unit was changed over to topping duties.

The advent of the 1920's saw the appearance of other companies operating to-day: Apex, Trinidad Petroleum Development, and Kern become established, the eventual successful development of Guayaguayare as an oilfield is achieved, and great technological advances are made in both producing and refining. The era is then entered when some of our members present tonight were actively engaged in the industry in Trinidad.

Whereas, to the economy of Trinidad and Tobago, the oil industry is of the greatest importance, on a free world basis our volume contribution is small—about ½ per cent. However, on a technological basis the contribution of Trinidad's oilmen has been significant and the efficiency of the producing and refining operations highly commendable. The industry in Trinidad has recorded a number of notable "firsts"; to quote but two, gamma ray well logging on the producing side, and commerical *n*-butane isomerization in the refining industry.

Most of the colour of the early oil pioneering days has long since gone, but the challenge to the oil technologist in this dynamic and highly-competitive industry is greater to-day than ever before.

# *U.K. Consumption in the First Half of 1960*

United Kingdom deliveries of petroleum products (excluding bunkers) rose by 18·7 per cent in the first half of 1960 compared with the January–June period of 1959. The total for the 1960 half-year was 21,209,272 tons, an increase of 3,347,668 tons, according to the Petroleum Industry Advisory Committee statistics published by the Petroleum Information Bureau.

The only products not to increase in use in the first half of 1960 were vaporizing oil, and paraffin wax and scale, the consumption of which has remained at a fairly constant level throughout recent years with only small increases or decreases in period comparisons. Motor spirit registered a rise of 8 per cent, which was a slight acceleration in the recent rate of growth. Fuel oil consumption showed an increase of over 29 per cent. Large increases were also achieved by propane and butane, 25 per cent; bitumen, 12 per cent; and the ever-increasing category of "other products", which had a spectacular rise of over 62 per cent to achieve a level of more than 1 million tons for the first time in a half-year.

Full details are given in the table below.

U.K. Deliveries into Inland Consumption of Petroleum Products

| *Product* | *January to June* | |
|---|---|---|
| | 1959 | 1960 |
| | *tons* | *tons* |
| Aviation fuels ... ... | 716,452 | 804,436 |
| Motor spirit (incl. motor benzole): | | |
| Premier grades... ... | 2,040,353 | 2,368,939 |
| Standard grades ... | 1,311,037 | 1,267,966 |
| | 3,351,390 | 3,636,905 |
| Industrial spirits (incl. industrial benzole) ... | 99,445 | 114,242 |
| White spirit ... ... | 78,031 | 80,321 |
| Kerosine: | | |
| Burning oil ... ... | 697,703 | 715,855 |
| Vaporizing oil ... ... | 209,758 | 162,743 |
| | 907,461 | 878,598 |
| Derv fuel ... ... | 1,092,691 | 1,251,816 |
| Gas, diesel, and fuel oils: | | |
| Gas/diesel oil ... ... | 1,594,814 | 1,767,923 |
| Fuel oil ... ... | 6,868,013 | 8,860,106 |
| Refinery consumption | 1,499,861 | 1,637,466 |
| | 9,962,688 | 12,265,495 |
| Lubricating oils and greases ... ... | 445,306 | 488,544 |
| Paraffin wax and scale ... | 25,744 | 25,561 |
| Petroleum gases ... ... | 58,002 | 72,495 |
| Bitumen ... ... ... | 475,332 | 533,727 |
| Other products ... ... | 649,062 | 1,057,132 |
| | 17,861,604 | 21,209,272 |

# Around the Branches

ABADAN, BAHRAIN, ESSEX, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD, YORKSHIRE

### Trinidad Branch Annual Dinner

The Trinidad Branch of the Institute held their 22nd Annual Dinner on 23 April at the Bretton Hall, Port of Spain. Nearly 100 members and guests were present. The guests of the Branch were K. W. Finch, chairman of the Joint Group (Engineering), Dr. S. D. Sampath, president of the BMA in Trinidad, and W. N. Foster, the Government Petroleum Technologist. Amongst the guests of the members were Sir Mathieu Perez; C. A. Kelsick, acting attorney-general; Mr Justice Corbin; Captain Watson, harbour master; and Captain Scheult, the pilot master. Unfortunately, His Excellency the Governor was unable to attend due to other commitments.

Following the Loyal Toast, the chairman of the Branch, Dr A. L. Down, addressed the assembly on the subject of "The History of Trinidad Oil". His address is reproduced in full elsewhere in this issue.

He concluded by saying that the Trinidad Branch was justly proud of the contribution that its members had made in the past and was confident that they would live

AT THE TRINIDAD BRANCH TWENTY-SECOND ANNUAL DINNER

(Left) *W. Q. Poole, Branch honorary secretary (right) with D. G. Day (right) and a guest.* (Centre) *The Branch chairman, Dr A. L. Down (right) in conversation with J. Hutchinson and F. Brown.* (Right) *K. W. Finch (left), chairman of the Joint Group, with D. P. Holbrook*

(Left) *A general view of the gathering and* (right) *J. Nicholson (Shell), J. Porter (TPD), and Sir Mathieu Perez (Shell)*

up to the technological challenge that now faced them.

K. W. Finch, chairman of the Joint Group, proposed the toast of the Institute of Petroleum in a pleasant speech that noted the many ways in which the members of the Institute had contributed to the technological advances of the petroleum industry and to the economy and well-being of Trinidad. He was sure that this would continue to be so in the future. In reply, D. J. P. Holbrook, committee member, thanked Mr Finch for the very kind words concerning the Institute and its members, and went on to discuss briefly the important role of the Institute of Petroleum, and the part played by the Trinidad Branch, in trying to achieve its aims and objects of promoting further the study of petroleum and allied products. The effectiveness of the Institute rose in direct proportion to the number of active members and a gratifying increase in the local membership had been noted this year. Mr Holbrook stated how pleased the Branch was to see guests from so many spheres and activities representing a cross-section of Trinidad's professional and business world, and welcomed them on behalf of the Branch.

His toast to the guests was ably replied to by Dr S. D. Sampath, and on their behalf he thanked the Trinidad Branch for a most enjoyable evening.

**London Branch—Summer Outing**

It may be remembered that before the weather went "on stream" Britain did enjoy a few fine days. On one of these, 27 May, the London Branch held their summer outing.

After some anxious moments for the organizers when the coach was delayed by the inevitable London traffic jam, the party journeyed to Egham, where they were to be entertained at Park Close, a delightful country house set in beautiful grounds, by Stanhope-Seta Ltd.

After being met by committee member Garry Richardson and Mr Richardson Senior—both executives of the Company—the party took coffee on the terrace overlooking an ornamental lake, and a lawn which was only matched by the envy of amateur gardeners present.

Following lunch at the Pantiles Restaurant, near Bagshot, the party was met by Mr Sigrit, information officer of the RAE, and commenced a most interesting tour of the Establishment, including visits to the structures department, the "Skylark" experimental rocket laboratory, and both the trans-sonic and hyper-sonic wind tunnels. At the latter, members were able to hear something of the problems encountered during high-speed flight and "re-entry", and many interesting questions were asked on the subject by the visitors.

A leisurely journey back with tea in the rural setting of a roadside hotel concluded a most enjoyable day.

# *M.O.A. Approved HD Oils*

The following additional oils have been approved by the Director of Chemical Inspection, Ministry of Aviation, as complying with the requirements of Defence Specification DEF-2101.

| *Supplier and supplier's nomenclature* | *OMD grade of oil* |
|---|---|
| AB Nynäs Petroleum | |
| Nynäs 13/58 HD 30 | 110 |
| Nynäs 18 DM 30 | 110 |
| AGIP, Italy | |
| AGIP SAE 10W | 40 |
| Ampol Petroleum Ltd | |
| Ampol Deulube 20/20W HDL | 60 |
| Ampol Deulube 30 HDL | 110 |
| Ampol Deulube 50 HDL | 330 |
| Aquila SpA | |
| Aquiloil HSD 130 | 110 |
| Beverol Fabrieken NV | |
| Beverol Gold HD | 330 |
| BP Australia Ltd | |
| B.P. 2108 | 40 |
| B.P. 2204 | 60 |
| B.P. 2329 | 110 |
| BP Trading Ltd | |
| BP 2349 | 110 |
| BP 2513 | 330 |
| A Duckham & Co. | |
| — | 60 |
| G. E. R. Deurag Nerag | |
| Nerag motorenoel HD SAE 20W/20 | 60 |
| Mobil Oil Co. | |
| TSL 1102 | 330 |
| — | 40 |
| — | 330 |
| Mobil Oil Co. Ltd | |
| — | 110 |
| — | 110 |
| Mobil Oil Italiana SpA | |
| Mobiloil A | 110 |
| Delvac oil S 130 | 110 |
| Morris & Co. (Shrewsbury) Ltd | |
| Golden Film Ring Free 110 | 40 |

| *Supplier and supplier's nomenclature* | *OMD grade of oil* |
|---|---|
| National Iranian Oil Co. Ltd | |
| Iranol SAE 30 | 110 |
| Netherlands Sun Oil Co. | |
| Sun Solvent Refined HD Oil | 60 |
| Purfina Francais SA | |
| Solna HD | 110 |
| Regent Oil Co. Ltd | |
| GB 1 C | 40 |
| Shell International Petroleum Co. Ltd | |
| Shell oil S.5700 | 60 |
| Shell oil S.5786 | 110 |
| Shell RD 30/1 | 110 |
| Shell oil S.5875 | 110 |
| BP 2114 | 110 |
| Shell oil S.5878 | 110 |
| Shell oil S.5879 | 110 |
| Stevinson Hardy & Co. Ltd | |
| SH.17 | 110 |
| Vacuum Oil Co. Australia | |
| Vacuum oil OMD 60 | 60 |
| Vacuum oil OMD 109/112 | 110 |
| Vacuum oil OMD 110 | 110 |
| Vacuum Oil Co. Pty Ltd | |
| Vacuum oil OMD 330 | 330 |
| Valvoline Oil Co. | |
| Super HPO SI(E) SAE 10 | 40 |
| Super HPO SI(E) SAE 20 | 60 |
| Super HPO SI(E) SAE 30 | 110 |
| C. C. Wakefield & Co. Australia | |
| Wakefield Product H52/57 | 40 |
| Wakefield Product 20/59/BP | 60 |
| Wakefield Product 20/59/S | 60 |
| Wakefield Product HL/181/56 | 110 |
| Wakefield Product TH 1751 | 330 |
| C. C. Wakefield & Co. Ltd | |
| Wakefield Product HL/146/55 | 40 |
| Wakefield Product 30/59/S | 110 |

# Personal Notes

**G. Davidson**, B.Sc., F.R.I.C., M.Inst.Pet., has retired from his position as vice-president (manufacturing) of Shell Oil Company of Canada. He has accepted an assignment with the International Labour Office in Central America, and will be moving to San Salvador shortly. Prior to his retirement from Shell he had been associated with the Company since 1925, when he joined the Tampico refinery of Mexican Eagle Oil Company. After occupying various positions, including that of assistant manager at Shell's Stanlow refinery (1940–44), he went to Canada in 1951 as manager of the Montreal East refinery. He was made a director of Shell Oil Company of Canada Ltd in 1958, and a vice-president in 1960.

**Dr Alexander Lewis, Jr.** has been elected vice-president of the Gulf Oil Corporation. Formerly manager of the Petrochemicals Department, Dr Lewis will continue to direct the Company's world-wide petrochemical interests.

He began working for Gulf in 1935 at its Philadelphia refinery, and later served as organic chemist in the refinery technology laboratory at Philadelphia. Dr Lewis received his M.Sc. degree from the University of Pennsylvania in 1940, and upon his return to Gulf in 1946 was appointed a Fellow on the Gulf Fellowship at the Mellon Institute of Industrial Research in Pittsburgh, where he was awarded a Ph.D. degree in 1951. In the succeeding years he was appointed chief product engineer of the then Product Development Section of the Domestic Marketing Department; manager, chemical marketing; and, in 1958, manager of the Petrochemicals Department.

His Highness the Ruler of Kuwait has nominated two Kuwaiti nationals to be directors of Kuwait Oil Company Ltd. They are **Feisal Mansour Mazidi** and **Mahmoud Khalid al-Adasani.** Mr Mazidi graduated in economics with honours from the University College of North Staffordshire, Keele, in 1959. Mr Adasani graduated in petroleum engineering from the University of Southern California, Los Angeles, in 1958.

The board, therefore, will now consist of ten directors—a managing and assistant managing director, two Kuwait Government-appointed directors, and six other directors appointed equally by the shareholders, BP (Kuwait) Ltd, and Gulf Kuwait Company. In addition, there is one advisory director, Sir Philip Southwell, C.B.E., M.C.

**S. H. Oliver** has been appointed manager of the Purchasing Department of Castrol Ltd in succession to the late **A. J. Stafford.** Mr Oliver joined W. B. Dick & Co. Ltd in 1932, and entered his present department when that Company joined the Castrol Group some years later. He became assistant purchasing manager early last year.

The death is announced with regret of **P. W. L. Gossling**, B.Sc., F.Inst.Pet., the laboratory manager of the Castrol Group. Mr Gossling, who was 57, had served the Group for 36 years, and was appointed the laboratory manager in January 1955.

**J. E. Roach** has retired from the managing directorship and from the board of Daniel Adamson & Company Ltd.

**Otto F. Reichwald** has been elected a director in his place, and will take up the full-time appointment as managing director later in the year.

*J. F. Robinson*

*D. Holmes*

The composition of the board of Costain & Press (Overseas Services) Ltd is now announced, and is composed as follows: **Sir Richard Costain**, C.B.E. (chairman), **Col. P. McA. Sinclair**, M.C.; **J. B. Parrett**, A.A.C.C.A.; and **J. F. Robinson**, B.Sc. (Lond.) (joint managing) from Richard Costain. **K. P. Allpress**, M.A. (deputy chairman), **W. H. G. Roach**, M.B.E., F.C.G.I., M.Inst.C.E., M.Inst.GasE.; **E. Hatton Miller**, F.A.C.C.A.; and **Donald Holmes**, A.M.I.Mech.E., M.Inst.Pet. (joint managing) with **R. Y. Stevens** alternating from William Press.

As a first step in developing the business of Metal Cleaning Ltd, the newest member of the Castrol Group of Companies, the board of directors has been reconstituted.

*L. M. Broadway*

The new chairman is **Leonard M. Broadway**, deputy chairman and managing director of Castrol Ltd. **J. A. V. Watson**, O.B.E., another Castrol director, is deputy chairman of Metal Cleaning Ltd, and **Arthur Owen** is managing director.

The other members of the new board are **E. B. Bishop**, F.C.W.A., A.C.I.S., **J. C. Cragg**, B.Sc., F.R.I.C., F.Inst.Pet., **George Owen**, and **G. J. B. Williams** who is also secretary to the Company.

**Robert H. Scholl**, formerly executive vice-president of Esso Standard, Division of Humble Oil & Refining Company, has been named SONJ director of public relations. **Stewart Schackne**, formerly public relations department manager, has been named public relations counsellor to concentrate particularly on planning and creative activities.

Mr Scholl joined the law department of Esso Standard Oil Co. in 1937. He became general counsel of the Company, was later elected vice-president and member of its board of directors, and was made executive vice-president last year. Mr Schackne was made assistant public relations manager of Jersey Standard in 1945 after having worked with the Company's outside consultant firm. He was made manager in 1954.

Edwin Cooper & Co. Ltd, a member of the Castrol Group of Companies, has appointed **B. J. Storrar** as sales manager.

Basil Storrar joined Castrol's Overseas Division in 1947, and in 1950 transferred to Deutsche Castrol GmbH as assistant manager. In 1956 he returned to head office and a year later was posted to Switzerland to take control of Castrol Switzerland SA. He returned to the U.K. in April this year.

*B. Storrar*

*K. L. Byerly*

**K. L. Byerly** has been named vice-president, U.S. domestic sales, and **John C. Orton,** vice-president, export, of Security Engineering Division, Dresser Industries.

Mr Byerly joined Security from another Dresser affiliate, Magcobar de Venezuela, where he was vice-president and general manager.

Mr Orton joined Security after nine years with Reed Roller Bit Company—as division sales manager in various parts of Latin America, and as sales division manager, Eastern Hemisphere, in London.

*J. C. Orton*

**J. C. G. Boot,** RoyalDutch/Shell Group personnel co-ordinator, has moved his office from London to The Hague. He has resigned from the board of directors of Shell International Petroleum Company Ltd and has been appointed to the board of directors of Bataafse Internationale Petroleum Mij NV.

**S. H. Wood,** manager of National Benzole's Pump Department, has retired after thirty-nine years service with the Company.

He joined the Motor Owners Petrol Combine, which marketed Rumanian motor spirit, as a sales representative in 1913, and at one time was manager of National Benzole's Plymouth Division.

He is succeeded by **R. W. Bartle,** assistant manager, Pump Department, who joined National Benzole in 1920.

**William Edward Dickson** has been named geophysical supervisor in Madrid for Geophysical Service Inc, where he will be responsible for the operations of GSI exploration field parties in the Spanish Sahara. Mr Dickson has been with GSI since 1931, and in recent years has served as seismic operations supervisor in Canada, and at the Company's London office.

**Lewis Sole,** a twenty-five year veteran with GSI, will join the personnel department in Dallas as administrator for field parties in the Eastern Hemisphere and Latin America.

**Edwin Baden,** F.R.S.H., F.I.P.H.E., has been appointed chairman of Matthew Hall and Co., and has resigned as managing director. **R. R. Baden,** M.A., has been appointed deputy chairman, and **P. D. Doulton,** M.I.Mech.E., M.Inst.Pet., M.I.Chem.E., and **S. Kindler,** M.I.P.H.E., M.A.S.H.R.A.E., appointed managing directors. **R. M. Speir,** M.P., has been appointed a director.

With deep regret we record the death of **J. Victor Delves,** on 5 August last.

He was managing director of Tidewater Oil Company (England) Ltd from 1936 until his retirement in February 1958. During the war he served as deputy regional controller, Ministry of Production, East and West Riding Divisions.

*J. A. Petrie, Jr*

**James A. Petrie, Jr,** has been appointed assistant to the president of Kellogg International Corporation in London. He has been a member of the Kellogg organization for 24 years, and is assistant vice-president of the parent company and director of Kellogg International Corporation.

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## ASTM-IP PETROLEUM MEASUREMENT TABLES

When the Institute of Petroleum and the American Society for Testing Materials published jointly in 1952–53 their three volumes of petroleum measurement tables covering the British, U.S, and metric systems of units, an undertaking was given that a full report covering the work involved would be made available. Such a report has now been completed by the sections of the two institutions which were responsible for the compilation of the tables. Since then the ASTM-IP tables have received international recognition through their acceptance by the International Organization for Standardization as ISO Recommendation No R.91.

The report referred to, under the title "Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables", summarizes the history of the co-operation between the two bodies concerned, starting with the original work between 1912 and 1915 by the United States National Bureau of Standards, later confirmed by the Institute of Petroleum in 1940–41, and culminating in 1952–53 with the publication of *ASTM-IP Petroleum Measurement Tables*.

The basic data used in the formulae from which the tables were constructed, and which represented the latest and most up-to-date information that was then available, is given, together with all the constants and factors used in the calculations. The equations, calculation steps, and the number of significant figures retained in each step are detailed for every table.

The complicated procedure for the calculation of gravity, density, and volume reduction tables is fully explained and all intermediate steps detailed.

The 36-page report is available from The Institute, price 42*s* post paid.

# *World Petroleum Statistics—1959*

Only eight months after publishing their World Petroleum Statistics for 1958 (*IP Review*, February 1960) the U.S. Bureau of Mines has issued the statistics for 1959. This is the first time that this authoritative compendium of world oil information has been available for a year immediately preceding that in which it has been published. This is a most welcome innovation.

In addition, the statistics for 1959 have a greater coverage than hitherto; previous tables being expanded and important new ones introduced. World supply and demand is divided into crude petroleum and refined products, and the figures of total refinery input and output, and bunkers, are also included under this section. The country-by-country breakdown of the production of refined products now covers virtually all products and not merely "major products". The tables of domestic demand have also been expanded to include all petroleum products. New tables which have been included give full country-by-country details of imports, and exports and re-exports, respectively, of refined products. The Communist bloc is no longer included in any of the statistics.

World production of crude petroleum totalled 6074 million brl in 1959. This was 7 per cent greater than in 1958, with increases of 5 per cent in the U.S.A., 7 per cent in South America, and 8 per cent in the Middle East.

World imports of crude petroleum were 2351 million brl—a rise of some 8 per cent over 1958—and world exports and re-exports 2309 million brl. The gap of 42 million brl is about equal to the movement of crude petroleum to the non-Communist world from the Soviet bloc during the year.

Imports of refined products in the world during 1959 were 1133 million brl, and exports and re-exports 1247 million. It is said that the world import total is believed to be understated by approximately 191 million brl. This is the difference between the import and export and re-export totals—114 million brl—plus an estimated 77 million brl of refined products shipped from the Soviet bloc to reporting countries and not shown on the export totals. Actual world imports of products may therefore have been about 1324 million brl. The gap between actual and reported world imports is largely due to the failure of many countries to report as imports entries into bonded stocks and the use of such stocks for international bunkers; and also military deliveries.

In the refining sector, crude runs to stills are no longer itemized separately, and world output of refined products, including refinery fuel and loss, totalled 6303 million brl. This was an increase of approximately 5 per cent compared with 1958; the area with the largest rise being the Middle East with 14 per cent, followed by the Far East's 7 per cent. Most of the increase in product output was distillate fuel oil which rose by 7 per cent, and residual fuel oil which rose 3 per cent.

**Note:**

In line with the expanded coverage of the World Petroleum Statistics initiated in the January 1959 monthly issue, published annual data are shown, where available, in lieu of cumulated monthly totals. For a number of countries less than 12 months of data were available and annual estimates were made from the period reported. Where cumulated monthly data are shown, these frequently reflect substitution of actual data for estimates made in previously-published monthly reports.

The Bureau of Mines plans to publish a final adjusted summary for 1959 in the annual report for 1960.

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*World Petroleum Statistics*—1959, prepared by J. V. Hightower, Commodity-Industry Analyst, under the direction of Donald S. Colby, Branch of Petroleum Economics, Division of Petroleum, USBM, WPS No 142.

TABLE I
WORLD SUPPLY AND DEMAND CRUDE PETROLEUM AND REFINED PRODUCTS, 1959
(Thousands of barrels)

| Country | *Crude Petroleum* | | | | *Refined Products* | |
|---|---|---|---|---|---|---|
| | *Production* | *Imports* | *Exports and re-exports* | *Stock change, other demand, and loss* | *Imports* | *Exports and re-exports* |
| NORTH AMERICA | | | | | | |
| Canada | 184,768 | 115,289 | 33,362 | +226 | 38,880 | 1,457 |
| Mexico | 96,393 | 73 | 112 | −1,016 | 4,665 | 13,348 |
| United States (including Alaska) | 2,574,590 | 352,344 | 2,526 | +6,747 | 297,285 | 84,957 |
| Subtotal | 2,855,751 | 467,706 | 36,000 | +5,957 | 340,830 | 99,762 |
| CENTRAL AMERICA AND CARIBBEAN | | | | | | |
| Costa Rica | — | — | — | — | (*E*) 1,146 | — |
| Cuba | 209 | 25,402 | — | −453 | (*E*) 4,398 | — |
| Dominican Republic | — | — | — | — | (*E*) 2,036 | — |
| El Salvador | — | — | — | — | (*E*) 1,314 | — |
| Guatemala | — | — | — | — | 3,303 | — |
| Haiti | — | — | — | — | (*E*) 593 | — |
| Jamaica | — | — | — | — | 5,349 | — |
| Nicaragua | — | — | — | — | (*E*) 1,094 | — |
| Panama, Canal Zone | — | — | — | — | 7,209 | 1,972 |
| Panama, Republic | — | — | — | — | (*E*) 2,797 | 6 |
| Puerto Rico | — | 25,662 | — | −520 | 4,578 | 14,631 |
| Subtotal | 209 | 51,064 | — | −973 | 33,817 | 16,609 |
| SOUTH AMERICA | | | | | | |
| Argentina | 44,710 | 37,957 | — | +3,657 | 18,849 | 9 |
| Bolivia | 3,170 | — | 948 | +11 | 113 | 8 |
| Brazil | 23,590 | 42,223 | 11,123 | −1,458 | (*E*) 24,160 | — |
| British Guiana | — | — | — | — | 1,278 | 1 |
| Chile | 6,428 | 2,769 | — | +619 | (*E*) 7,140 | — |
| Colombia | 53,574 | — | 28,522 | +844 | — | 4,130 |
| Ecuador | 2,759 | 250 | 283 | −108 | 935 | — |
| Netherlands Antilles | — | 255,138 | — | −2,465 | (*E*) 25,478 | 245,749 |
| Paraguay | — | — | — | — | 723 | — |

TABLE I

WORLD SUPPLY AND DEMAND CRUDE PETROLEUM AND REFINED PRODUCTS, 1959—*(continued)*

(Thousands of barrels)

| Country | Crude Petroleum | | | | Refined Products | |
|---|---|---|---|---|---|---|
| | *Production* | *Imports* | *Exports and re-exports* | *Stock change, other demand, and loss* | *Imports* | *Exports and re-exports* |
| Peru | 17,733 | — | 2,110 | - 112 | 2,556 | 2,797 |
| Trinidad | 40,919 | 31,012 | 3,254 | - 49 | 2,455 | 54,874 |
| Uruguay | — | 8,300 | — | - 54 | 2,722 | 952 |
| Venezuela | 1,011,452 | — | 719,835 | - 5,281 | (*E*) 570 | 218,423 |
| Subtotal | 1,204,335 | 377,649 | 766,075 | - 4,074 | 86,979 | 526,943 |
| **WESTERN EUROPE** | | | | | | |
| Austria | 16,946 | 3,299 | 6,974 | - 138 | 6,806 | 1,334 |
| Belgium and Luxembourg | — | 49,387 | — | - 421 | 19,775 | 18,685 |
| Denmark | — | 269 | — | - 47 | 34,089 | 110 |
| Finland | — | 7,972 | — | — | 5,793 | — |
| France | 11,687 | 221,647 | — | - 7,528 | 14,300 | 48,386 |
| Germany, West | 36,981 | 122,693 | — | - 1,008 | 38,453 | 21,026 |
| Greece | — | 10,079 | — | - 77 | 2,947 | — |
| Iceland | — | — | — | — | 2,924 | — |
| Ireland | — | 5,772 | — | - 606 | 6,090 | 728 |
| Italy | 11,551 | 181,058 | 3,244 | - 1,777 | 5,651 | 49,295 |
| Netherlands | 12,367 | 85,764 | — | - 4,910 | 36,000 | 66,895 |
| Norway | — | 735 | — | + 42 | 23,435 | — |
| Portugal | — | 9,343 | — | - 635 | 2,515 | 2,134 |
| Spain | — | 30,217 | — | - 689 | 1,409 | — |
| Sweden | — | 17,255 | — | - 440 | 62,069 | 794 |
| Switzerland | — | — | — | — | 22,699 | 1 |
| United Kingdom | 621 | 285,118 | — | - 1,856 | 102,498 | 52,492 |
| Yugoslavia | 4,188 | (*E*) 4,489 | — | - 6 | (*E*) 838 | (*E*) 546 |
| Subtotal | 94,341 | 1,035,097 | 10,218 | - 2,640 | 388,291 | 262,426 |
| **MIDDLE EAST** | | | | | | |
| Aden | — | 30,781 | — | - 68 | 10,639 | 15,630 |
| Bahrain | 16,473 | 52,659 | — | - 174 | 449 | 60,351 |
| Iran | 344,800 | — | 212,657 | - 3,371 | — | 76,529 |
| Iraq | 311,193 | — | (*E*) 290,371 | - 8,194 | (*E*) 50 | — |
| Israel | 925 | (*E*) 8,555 | — | — | (*E*) 11,090 | — |
| Jordan | — | — | — | — | (*E*) 1,143 | — |
| Kuwait | 504,855 | — | 452,064 | - 775 | 197 | 27,708 |
| Lebanon | — | 5,493 | — | — | (*E*) 319 | — |
| Neutral Zone | 42,438 | — | (*E*) 32,500 | - 992 | — | (*E*) 7,350 |
| Qatar | 61,431 | — | 61,237 | — | — | — |
| Saudi Arabia | 399,821 | — | 334,848 | - 1,363 | 122 | 43,698 |
| Turkey | 2,700 | — | — | - 162 | 11,845 | — |
| U.A.R., Syria | — | (*E*) 1,830 | — | — | 3,566 | — |
| Subtotal | 1,684,636 | 99,318 | 1,383,677 | - 6,363 | 39,420 | 231,266 |
| **AFRICA** | | | | | | |
| Algeria | 10,205 | — | 6,563 | - 3,642 | 8,879 | — |
| Angola | 361 | 129 | — | - 7 | 939 | — |
| Belgian Congo | — | — | — | — | 3,579 | — |
| Canary Islands | — | 20,920 | — | - 93 | 1,195 | 15,330 |
| Ethiopia | — | — | — | — | (*E*) 696 | — |
| States formerly in French Equatorial Africa | 5,295 | — | 5,170 | - 125 | (*E*) 2,182 | — |
| French West Africa | — | — | — | — | (*E*) 4,091 | — |
| Ghana | — | — | — | — | 2,834 | — |
| Kenya | — | — | — | — | (*E*) 5,904 | 1,036 |
| Liberia | — | — | — | — | 386 | — |
| Madagascar | — | — | — | — | 986 | — |
| Morocco | 712 | (*E*) 515 | — | — | 4,285 | — |
| Nigeria | 4,067 | — | 4,067 | — | 5,637 | — |
| Rhodesia and Nyasaland | — | — | — | — | (*E*) 3,964 | — |
| Sudan | — | — | — | — | 3,148 | — |
| Tanganyika | — | — | — | — | 2,345 | 448 |
| Tunisia | — | — | — | — | 3,241 | — |
| Uganda | — | — | — | — | (*E*) 1,184 | 183 |
| Union of South Africa | — | 9,631 | — | - 55 | 19,429 | 3,002 |
| U.A.R., Egypt | 21,303 | 11,336 | 7,483 | - 56 | 7,466 | 1,474 |
| Subtotal | 41,943 | 42,531 | 23,283 | - 3,978 | 82,370 | 21,473 |
| **SOUTH ASIA, FAR EAST, AND OCEANIA** | | | | | | |
| Australia | — | 73,545 | — | - 460 | 11,994 | 7,352 |
| British Borneo | 40,072 | — | 24,696 | — | 844 | 14,937 |
| Burma | 3,967 | — | — | - 444 | (*E*) 594 | — |
| Ceylon | — | — | — | — | 7,191 | 4 |
| India | 3,377 | 36,037 | — | + 2,338 | 13,482 | 2,067 |
| Indonesia | 139,038 | (*E*) 11,435 | 61,661 | + 6,014 | (*E*) 1,908 | (*E*) 43,918 |
| Japan | 2,852 | 139,080 | — | - 1,236 | 23,061 | 2,681 |
| Korea, South | — | — | — | — | (*E*) 10,953 | — |
| Malaya and Singapore | — | 2,139 | 1,910 | - 229 | 41,601 | 17,474 |
| Netherlands New Guinea | 1,656 | — | (*E*) 1,656 | — | — | — |
| New Caledonia | — | — | — | — | 377 | — |
| New Zealand | — | — | — | — | 13,090 | — |
| Pakistan | 2,333 | — | — | - 51 | 7,924 | — |
| Philippines | — | 8,662 | — | - 280 | 10,305 | — |
| Taiwan | 13 | 7,235 | — | - 785 | 4,634 | 58 |
| Thailand | — | — | — | — | 7,705 | — |
| Vietnam, South (including Cambodia) | — | — | — | — | 5,534 | — |
| Subtotal | 193,308 | 278,133 | 89,923 | - 7,885 | 161,197 | 88,491 |
| **WORLD TOTAL EXCLUDING EASTERN EUROPE, U.S.S.R., and MAINLAND CHINA** | 6,074,523 | 2,351,498 | 2,309,176 | - 21,776 | 1,132,904 | 1,246,970 |

(*E*) Estimate based on latest available data.

TABLE II

WORLD OUTPUT REFINED PRODUCTS, 1959*

(Thousands of barrels)

| | Gasoline (a) | Kerosine and jet fuel (b) | Distillate fuel oil | Residual fuel oil | Lubricants (incl. grease) | Other refined products | Refinery fuel and loss | Total refined products |
|---|---|---|---|---|---|---|---|---|
| **NORTH AMERICA** | | | | | | | | |
| Canada | 98,252 | 18,121 | 74,413 | 37,354 | 1,993 | 31,580 | 8,111 | 269,824 |
| Mexico | 27,116 | 11,296 | 11,112 | 39,168 | 1,043 | 2,795 | 12,402 | 104,932 |
| United States (incl. Alaska) | 1,473,430 | 203,595 | 678,938 | 347,900 | 56,111 | 311,010 | (c) | 3,070,984 |
| Subtotal | 1,598,798 | 233,012 | 764,463 | 424,422 | 59,147 | 345,385 | (c) 20,513 | 3,445,740 |
| **CENTRAL AMERICA AND CARIBBEAN** | | | | | | | | |
| Costa Rica | — | — | — | — | — | — | — | — |
| Cuba | 5,568 | 1,045 | 5,493 | 12,067 | — | 1,166 | 725 | 26,064 |
| Dominican Republic | — | — | — | — | — | — | — | — |
| El Salvador | — | — | — | — | — | — | — | — |
| Guatemala | — | — | — | — | — | — | — | — |
| Haiti | — | — | — | — | — | — | — | — |
| Jamaica | — | — | — | — | — | — | — | — |
| Nicaragua | — | — | — | — | — | — | — | — |
| Panama, Canal Zone | — | — | — | — | — | — | — | — |
| Panama, Republic | — | — | — | — | — | — | — | — |
| Puerto Rico | 10,306 | 883 | 4,298 | 8,882 | — | 1,045 | 1,917 | 27,331 |
| Subtotal | 15,874 | 1,928 | 9,791 | 20,949 | — | 2,211 | 2,642 | 53,395 |
| **SOUTH AMERICA** | | | | | | | | |
| Argentina | 14,157 | 9,286 | 12,003 | 36,225 | 863 | 6,136 | 363 | 79,033 |
| Bolivia | 860 | 348 | 331 | 626 | — | — | 46 | 2,211 |
| Brazil | 19,675 | 2,467 | 6,606 | 21,207 | — | 4,244 | 1,949 | 56,148 |
| British Guiana | — | — | — | — | — | — | — | — |
| Chile | 3,942 | 720 | 1,764 | 1,673 | — | 271 | 307 | 8,677 |
| Colombia | 8,631 | 1,652 | 3,255 | 9,386 | 99 | 2,371 | 463 | 24,931 |
| Ecuador | 886 | 253 | 641 | 748 | — | 272 | 34 | 2,834 |
| Netherlands Antilles | 36,311 | 25,384 | 40,862 | 132,513 | 2,324 | 20,666 | 13,950 | 272,010 |
| Paraguay | — | — | — | — | — | — | — | — |
| Peru | 4,891 | 3,270 | 4,903 | 2,314 | 65 | 283 | 62 | 15,664 |
| Trinidad | 11,908 | 2,921 | 13,415 | 35,068 | — | 5,247 | 556 | 69,115 |
| Uruguay | 1,972 | 1,362 | 875 | 3,902 | — | 134 | 109 | 8,354 |
| Venezuela | 40,102 | 13,184 | 53,513 | 170,721 | 1,247 | 20,670 | 446 | 298,991 |
| Subtotal | 143,335 | 60,847 | 138,168 | 414,383 | 4,598 | 60,294 | 16,343 | 837,968 |
| **WESTERN EUROPE** | | | | | | | | |
| Austria | 2,444 | 264 | 4,691 | 4,900 | 456 | 400 | 526 | 13,681 |
| Belgium and Luxembourg | 11,556 | 2,182 | 13,500 | 14,150 | 225 | 3,074 | 4,694 | 49,381 |
| Denmark | — | — | 53 | — | — | 161 | 8 | 222 |
| (E) Finland | 3,285 | 296 | 2,131 | 1,971 | — | 176 | 113 | 7,972 |
| France | 55,081 | 9,115 | 51,331 | 67,949 | 4,179 | 24,322 | 14,064 | 226,041 |
| Germany, West | 38,029 | 2,109 | 33,048 | 51,867 | 3,003 | 25,433 | 7,193 | 160,682 |
| Greece | 991 | 1,190 | 2,723 | 3,913 | — | 202 | 983 | 10,002 |
| Iceland | — | — | — | — | — | — | — | — |
| Ireland | 963 | 52 | 1,769 | 1,681 | — | 280 | 421 | 5,166 |
| Italy | 31,903 | 7,960 | 49,426 | 77,310 | 1,131 | 14,021 | 10,178 | 191,929 |
| Netherlands | 25,181 | 7,450 | 21,500 | 40,882 | 1,457 | 10,498 | 8,076 | 115,044 |
| Norway | 112 | — | 167 | 18 | 127 | 239 | 30 | 693 |
| Portugal | 2,613 | 1,308 | 1,816 | 2,769 | — | 1,173 | 299 | 9,978 |
| Spain | 5,259 | 2,070 | 6,305 | 13,325 | 259 | 621 | 2,426 | 30,265 |
| Sweden | 1,839 | 1,169 | 3,910 | 9,150 | 72 | 1,309 | 246 | 17,695 |
| Switzerland | — | — | — | — | — | — | — | — |
| United Kingdom | 65,289 | 14,334 | 55,121 | 103,982 | 6,107 | 18,855 | 20,195 | 283,883 |
| Yugoslavia | 2,187 | 491 | 2,473 | 2,419 | 359 | 408 | 334 | 8,671 |
| Subtotal | 246,732 | 49,990 | 249,964 | 396,286 | 17,375 | 101,172 | 69,786 | 1,131,305 |
| **MIDDLE EAST** | | | | | | | | |
| Aden | 3,926 | 3,311 | 5,937 | 14,679 | — | 893 | 1,967 | 30,713 |
| Bahrain | 14,046 | 8,677 | 15,777 | 26,082 | — | 631 | 3,931 | 69,144 |
| Iran | 28,240 | 22,816 | 24,058 | 45,275 | 98 | 1,596 | 13,428 | 135,514 |
| (E) Iraq | 2,179 | 1,893 | 2,549 | 4,842 | — | 503 | 672 | 12,638 |
| Israel | 1,563 | 1,368 | 2,272 | 3,480 | — | 700 | 97 | 9,480 |
| Jordan | — | — | — | — | — | — | — | — |
| Kuwait | 904 | 301 | 9,159 | 39,734 | — | 37 | 1,881 | 52,016 |
| Lebanon | 1,016 | 523 | 1,282 | 2,446 | — | 118 | 108 | 5,493 |
| (E) Neutral Zone | — | — | — | 9,150 | — | 1,350 | 430 | 10,930 |
| (E) Qatar | 72 | 24 | 60 | 24 | — | — | 14 | 194 |
| Saudi Arabia | 8,148 | 8,003 | 10,546 | 31,171 | — | 4,970 | 772 | 63,610 |
| Turkey | 675 | — | 268 | 1,224 | — | 269 | 102 | 2,538 |
| (E) U.A.R., Syria | 328 | 220 | 440 | 712 | — | 56 | 74 | 1,830 |
| Subtotal | 61,097 | 47,136 | 72,348 | 178,822 | 98 | 11,123 | 23,476 | 394,100 |
| **AFRICA** | | | | | | | | |
| Algeria | — | — | — | — | — | — | — | — |
| Angola | 77 | 8 | 107 | 270 | — | — | 21 | 483 |
| Belgian Congo | — | — | — | — | — | — | — | — |
| Canary Islands | 2,949 | 822 | 4,965 | 9,113 | 111 | 4,518 | 1,102 | 23,580 |
| Ethiopia | — | — | — | — | — | — | — | — |
| States formerly in French Equatorial Africa | — | — | — | — | — | — | — | — |
| French West Africa | — | — | — | — | — | — | — | — |
| Ghana | — | — | — | — | — | — | — | — |
| Kenya | — | — | — | — | — | — | — | — |
| Liberia | — | — | — | — | — | — | — | — |
| Madagascar | — | — | — | — | — | — | — | — |
| Morocco | 398 | 69 | 284 | 161 | — | 266 | 49 | 1,227 |
| Nigeria | — | — | — | — | — | — | — | — |
| Rhodesia and Nyasaland | — | — | — | — | — | — | — | — |
| Sudan | — | — | — | — | — | — | — | — |
| Tanganyika | — | — | — | — | — | — | — | — |
| Tunisia | — | — | — | — | — | — | — | — |
| Uganda | — | — | — | — | — | — | — | — |
| Union of South Africa | 2,957 | 1,129 | 2,403 | 1,778 | — | 1,251 | 58 | 9,576 |
| (E) U.A.R., Egypt | 2,600 | 2,900 | 2,700 | 16,000 | — | 200 | 700 | 25,100 |
| Subtotal | 8,981 | 4,928 | 10,459 | 27,322 | 111 | 6,235 | 1,930 | 59,966 |

TABLE II

WORLD OUTPUT REFINED PRODUCTS, 1959*—*(continued)*

(Thousands of barrels)

| | *Gasoline (a)* | *Kerosine and jet fuel (b)* | *Distillate fuel oil* | *Residual fuel oil* | *Lubricants (incl. grease)* | *Other refined products* | *Refinery fuel and loss* | *Total refined products* |
|---|---|---|---|---|---|---|---|---|
| **SOUTH ASIA, FAR EAST, AND OCEANIA** | | | | | | | | |
| Australia | 28,262 | 2,633 | 15,573 | 19,458 | 215 | 2,904 | 6,688 | 75,733 |
| (*E*) British Borneo | 3,121 | — | 7,750 | 3,014 | — | 784 | 707 | 15,376 |
| Burma | 1,257 | 775 | 689 | 563 | — | 98 | 141 | 3,523 |
| Ceylon | — | — | — | — | — | — | — | — |
| (*E*) India | 8,025 | 5,190 | 10,337 | 10,528 | — | 2,258 | 738 | 37,076 |
| (*E*) Indonesia | 13,869 | 10,782 | 17,927 | 18,164 | — | 22,999 | 4,278 | 88,019 |
| Japan | 32,098 | 11,511 | 18,387 | 61,486 | 3,332 | 10,628 | 5,726 | 143,168 |
| Korea, South | — | — | — | — | — | — | — | — |
| Malaya and Singapore | — | — | — | — | — | — | — | — |
| Netherlands New Guinea | — | — | — | — | — | — | — | — |
| New Caledonia | — | — | — | — | — | — | — | — |
| New Zealand | — | — | — | — | — | — | — | — |
| Pakistan | 708 | 111 | 498 | 735 | 42 | 97 | 91 | 2,282 |
| Philippines | 3,348 | 625 | 1,736 | 2,817 | — | 14 | 402 | 8,942 |
| Taiwan | 1,452 | 975 | 1,148 | 2,305 | — | 260 | 323 | 6,463 |
| Thailand | — | — | — | — | — | — | — | — |
| Vietnam, South (incl. Cambodia) | — | — | — | — | — | — | — | — |
| Subtotal | 92,140 | 32,602 | 74,045 | 119,070 | 3,589 | 40,042 | 19,094 | 380,582 |
| **EUROPE, U.S.S.R., and MAINLAND CHINA** | 2,166,957 | 430,443 | 1,319,238 | 1,581,254 | 84,918 | 566,462 | (*c*) 153,784 | 6,303,056 |

* Excludes LPG sold directly for fuel and chemical uses from natural gasoline plants.

(*a*) Gasoline includes the following reported amounts of aviation gasoline (1,000 barrels): Canada 668; Mexico 374; United States 88,969; Puerto Rico 190; Argentina 423; Columbia 458; Peru 203; Uruguay 20; Venezuela 1,840; France 917; Iran 4,532; Saudi Arabia 86; Australia 334.

(*b*) Total includes the following reported amounts of jet fuel (1,000 barrels): Canada 4,202; Mexico 67; United States 92,933; Puerto Rico 145; Colombia 24; Peru 64; Uruguay 38; Venezuela 2,862; France, 5,543; West Germany 1,752; Greece 489; Ireland 2; Italy 4,501; Portugal 156; Sweden 1,025; Aden 953; Bahrain 2,658; Iran 3,593; Kuwait 13; Saudi Arabia 3,119; Union of South Africa 62; Australia 1,607; Philippines 77.

(*c*) Refinery fuel and loss in the United States data are included in residual fuel and other.

(*E*) Estimates based on latest available data.

TABLE III

DOMESTIC DEMAND REFINED PRODUCTS, BY COUNTRIES, 1959*

(Thousands of barrels)

| *Country* | *Gasoline (incl. motor and aviation)* | *Kerosine and jet fuel* | *Distillate fuel oil* | *Residual fuel oil* | *Lubricants (including grease)* | *Other refined products* | *Refinery fuel and loss* | *Total domestic demand* |
|---|---|---|---|---|---|---|---|---|
| **NORTH AMERICA** | | | | | | | | |
| (*a*) Canada | 100,589 | 20,247 | 83,646 | 58,710 | 3,345 | 20,985 | 8,111 | 295,633 |
| Mexico | 28,445 | 11,132 | 11,197 | 27,923 | 1,158 | 3,992 | 12,402 | 96,249 |
| (*a*) United States (incl. Alaska) | 1,479,907 | 214,220 | 659,406 | 558,800 | 42,717 | 484,028 | (*b*) | 3,439,078 |
| Subtotal | 1,608,941 | 245,599 | 754,249 | 645,433 | 47,220 | 509,005 | (*b*) 20,513 | 3,830,960 |
| **CENTRAL AMERICA AND CARIBBEAN** | | | | | | | | |
| Costa Rica | 427 | 61 | 438 | 141 | 41 | 38 | — | 1,146 |
| Cuba | 6,504 | 1,129 | 5,911 | 14,653 | 232 | 1,308 | 725 | 30,462 |
| Dominican Republic | 370 | 34 | 368 | 954 | 92 | 218 | — | 2,036 |
| El Salvador | 628 | 191 | 175 | 218 | 16 | 86 | — | 1,314 |
| Guatemala | 1,012 | 172 | 647 | 1,225 | 43 | 204 | — | 3,303 |
| Haiti | 396 | 36 | 156 | — | 5 | — | — | 593 |
| Jamaica | 799 | 271 | 917 | 3,324 | 36 | 2 | — | 5,349 |
| Nicaragua | 458 | 132 | 452 | — | 24 | 28 | — | 1,094 |
| Panama, Canal Zone | 340 | 5 | 2,129 | 2,750 | — | 13 | — | 5,237 |
| Panama, Republic | 1,036 | 233 | 597 | 891 | 34 | — | — | 2,791 |
| Puerto Rico | 4,591 | 1,059 | 933 | 5,003 | 92 | 3,683 | 1,917 | 17,278 |
| Subtotal | 16,561 | 3,323 | 12,723 | 29,159 | 615 | 5,580 | 2,642 | 70,603 |
| **SOUTH AMERICA** | | | | | | | | |
| (*a*) Argentina | 14,481 | 10,612 | 15,650 | 41,145 | 1,153 | 3,106 | 363 | 86,510 |
| (*a*) Bolivia | 912 | 283 | 322 | 491 | 3 | 1 | 46 | 2,058 |
| (*a*) Brazil | 28,277 | 4,164 | 17,109 | 28,852 | 1,365 | 4,414 | 1,949 | 86,130 |
| British Guiana | 179 | 116 | 293 | 663 | 18 | 8 | — | 1,277 |
| (*a*) Chile | 4,280 | 1,540 | 1,930 | 7,240 | 210 | 200 | 307 | 15,707 |
| (*a*) Colombia | 8,529 | 1,547 | 2,742 | 4,819 | 249 | 813 | 463 | 18,236 |
| Ecuador | 1,493 | 253 | 803 | 748 | 54 | 384 | 34 | 3,769 |
| (*c*) Netherlands Antilles | 10,917 | 2,762 | 7,252 | 15,514 | 2,272 | 9,140 | 13,950 | 51,739 |
| (*a*) Paraguay | 281 | 96 | 83 | 165 | 14 | 1 | — | 640 |
| Peru | 4,911 | 2,476 | 3,731 | 3,882 | 160 | 325 | 62 | 15,423 |
| (*a*)(*c*) Trinidad | 830 | 316 | 5,377 | 8,887 | 40 | 626 | 556 | 16,632 |
| Uruguay | 2,101 | 1,433 | 1,410 | 4,871 | 66 | 134 | 109 | 10,124 |
| (*a*) Venezuela | 15,514 | 3,614 | 8,150 | 20,531 | 178 | 1,061 | 446 | 48,602 |
| Subtotal | 92,705 | 23,688 | 64,852 | 137,808 | 1,238 | 20,213 | 16,343 | 356,847 |
| **WESTERN EUROPE** | | | | | | | | |
| (*a*) Austria | 4,432 | 127 | 3,442 | 8,152 | 623 | 672 | 526 | 17,974 |
| (*a*) Belgium and Luxembourg | 9,180 | 500 | 14,174 | 13,653 | 882 | 4,708 | 4,694 | 47,791 |
| Denmark | 8,103 | 1,257 | 10,470 | 12,466 | 461 | 1,436 | 8 | 34,201 |
| Finland | 3,472 | 477 | 7,368 | 1,971 | 188 | 176 | 113 | 13,765 |
| (*a*) France | 45,622 | 1,779 | 39,847 | 60,300 | 3,607 | 15,891 | 14,064 | 181,110 |
| (*a*) Germany, West | 43,761 | 800 | 37,055 | 84,529 | 4,285 | 17,486 | 7,193 | 195,109 |
| Greece | 1,325 | 1,319 | 3,518 | 5,289 | 147 | 368 | 983 | 12,949 |
| Iceland | 510 | — | 1,526 | 859 | 29 | — | — | 2,924 |
| (*a*) Ireland | 2,994 | 894 | 1,649 | 2,283 | 146 | 403 | 421 | 8,790 |
| (*a*) Italy | 20,184 | 3,174 | 18,704 | 64,207 | 1,701 | 3,487 | 10,178 | 121,635 |
| Netherlands | 9,043 | 4,442 | 13,568 | 38,026 | 1,032 | 9,962 | 8,076 | 84,149 |
| (*a*) Norway | 3,230 | 1,332 | 8,717 | 8,917 | 388 | 800 | 30 | 23,414 |
| Portugal | 2,010 | 1,335 | 2,918 | 2,441 | 180 | 1,176 | 299 | 10,359 |
| Spain | 5,728 | 2,238 | 6,596 | 13,325 | 740 | 621 | 2,426 | 31,674 |
| (*a*) Sweden | 12,486 | 1,744 | 28,206 | 32,381 | 735 | — | 246 | 75,798 |
| Switzerland | 7,206 | 576 | 1,679 | 12,761 | 366 | 110 | — | 22,698 |
| (*a*) United Kingdom | 79,404 | 17,372 | 47,149 | 138,045 | 6,598 | 18,240 | 20,195 | 327,003 |
| Yugoslavia | 2,132 | 491 | 2,731 | 2,346 | 458 | 471 | 334 | 8,963 |
| Subtotal | 260,822 | 39,857 | 249,317 | 501,951 | 22,566 | 76,007 | 69,786 | 1,220,306 |

TABLE III

DOMESTIC DEMAND REFINED PRODUCTS, BY COUNTRIES, 1959*—*(continued)*

(Thousands of barrels)

| Country | Gasoline (incl. motor and aviation) | Kerosine and jet fuel | Distillate fuel oil | Residual fuel oil | Lubricants (including grease) | Other refined products | Refinery fuel and loss | Total domestic demand |
|---|---|---|---|---|---|---|---|---|
| **MIDDLE EAST** | | | | | | | | |
| (c) Aden | 993 | 785 | 5,937 | 17,133 | — | 893 | 1,967 | 25,722 |
| Bahrain | 411 | 129 | 1,053 | 3,766 | 6 | 54 | 3 931 | 9,242 |
| (a) Iran | 3,796 | 5,720 | 4,426 | 21,362 | 100 | 492 | 13,428 | 49,324 |
| Iraq | 2,179 | 1,893 | 2,549 | 4,842 | 50 | 503 | 672 | 12,688 |
| Israel | 3,263 | 2,568 | 4,272 | 9,280 | 90 | 1,000 | 97 | 20,570 |
| Jordan | 365 | 310 | 419 | 36 | 13 | — | — | 1,143 |
| (c) Kuwait | 1,086 | 301 | 2,428 | 18,757 | 15 | 37 | 1,881 | 24,505 |
| Lebanon | 1,133 | 568 | 1,282 | 2,584 | 19 | 118 | 108 | 5,812 |
| Neutral Zone | — | — | — | 3,150 | — | — | 430 | 3,580 |
| Qatar | 72 | 24 | 60 | 24 | — | — | 14 | 194 |
| (a) Saudi Arabia | 1,625 | 484 | 923 | 10,879 | 38 | 249 | 772 | 14,970 |
| Turkey | 4,292 | 3,098 | 4,921 | 1,224 | 463 | 283 | 102 | 14,383 |
| U.A.R., Syria | 550 | 467 | 2,477 | 1,660 | 74 | 94 | 74 | 5,396 |
| Subtotal | 17,779 | 16,347 | 30,747 | 94,697 | 868 | 3,615 | 23,476 | 187,529 |
| **AFRICA** | | | | | | | | |
| (a) Algeria | 2,463 | 705 | 1,556 | 2,352 | 3 | — | — | 7,079 |
| (a) Angola | 380 | 80 | 567 | 286 | 43 | — | 21 | 1,377 |
| Belgian Congo | 1,630 | 329 | 1,158 | 209 | 120 | 133 | — | 3,579 |
| Canary Islands | 35 | 46 | 2,243 | 3,143 | — | 2,876 | 1,102 | 9,445 |
| Ethiopia | 586 | 24 | 60 | — | 26 | — | — | 696 |
| States formerly in French Equatorial Africa | 1,176 | 244 | 645 | — | 70 | 47 | — | 2,182 |
| French West Africa | 2,200 | 520 | 675 | 540 | 120 | 36 | — | 4,091 |
| Ghana | 1,162 | 374 | 799 | 326 | 89 | 84 | — | 2,834 |
| Kenya | 963 | 347 | 2,433 | 1,000 | 16 | 109 | — | 4,868 |
| Liberia | 149 | 100 | 130 | — | 7 | — | — | 386 |
| Madagascar | 465 | 120 | 327 | 5 | 36 | 33 | — | 986 |
| (a) Morocco | 2,155 | 392 | 1,340 | 1,459 | 72 | 266 | 49 | 5,733 |
| Nigeria | 2,307 | 1,012 | 1,606 | 404 | 101 | 207 | — | 5,637 |
| (a) Rhodesia and Nyasaland | 2,283 | 291 | 1,130 | — | 164 | 206 | — | 4,074 |
| Sudan | 786 | 335 | 641 | 1,319 | 50 | 17 | — | 3,148 |
| Tanganyika | 604 | 239 | 982 | — | 39 | 33 | — | 1,897 |
| (a) Tunisia | 722 | 371 | 913 | 1,207 | 59 | 127 | — | 3,399 |
| Uganda | 499 | 177 | 276 | — | 31 | 18 | — | 1,001 |
| Union of South Africa | 12,712 | 3,994 | 5,694 | 1,331 | 847 | 1,367 | 58 | 26,003 |
| U.A.R., Egypt | 1,887 | 5,383 | 3,828 | 18,865 | 335 | 94 | 700 | 31,092 |
| Subtotal | 35,164 | 15,083 | 27,003 | 32,446 | 2,228 | 5,653 | 1,930 | 119,507 |
| **SOUTH ASIA, FAR EAST, AND OCEANIA** | | | | | | | | |
| (a) Australia | 34,259 | 4,920 | 12,025 | 17,053 | 1,543 | 1,989 | 6,688 | 78,477 |
| British Borneo | 446 | 129 | 746 | 82 | 27 | 802 | 707 | 1,283 |
| Burma | 1,322 | 776 | 1,032 | 563 | 87 | 196 | 141 | 4,117 |
| Ceylon | 1,399 | 1,057 | 1,633 | 2,848 | 97 | 153 | — | 7,187 |
| India | 7,343 | 13,283 | 12,248 | 10,401 | 1,568 | 2,910 | 738 | 48,491 |
| (a) Indonesia | 6,221 | 8,653 | 4,680 | 6,162 | 335 | 1,278 | 4,278 | 31,607 |
| Japan | 30,545 | 11,510 | 24,534 | 75,786 | 3,730 | 11,717 | 5,726 | 163,548 |
| Korea, South | 3,337 | 1,083 | 3,544 | 2,580 | 18 | 391 | — | 10,953 |
| Malaya and Singapore | 2,649 | 1,361 | 6,286 | 13,355 | 188 | 288 | — | 24,127 |
| Netherlands New Guinea | — | — | — | — | — | — | — | Insig. |
| New Caledonia | 124 | 26 | — | 216 | 11 | — | — | 377 |
| New Zealand | 7,546 | 451 | 2,495 | 1,942 | 297 | 359 | — | 13,090 |
| Pakistan | 1,131 | 1,596 | 2,715 | 3,734 | 842 | 97 | 91 | 10,206 |
| Philippines | 7,026 | 1 819 | 4,214 | 4,829 | 384 | 573 | 402 | 19,247 |
| Taiwan | 1,452 | 975 | 1,148 | 6,939 | — | 202 | 323 | 11,039 |
| Thailand | 2,963 | 803 | 2,208 | 1,312 | 196 | 223 | — | 7,705 |
| Vietnam, South (incl. Cambodia) | 2,385 | 703 | 1,193 | 955 | 121 | 177 | — | 5,534 |
| Subtotal | 110,148 | 49,145 | 79,209 | 148,593 | 9,444 | 21,355 | 19,094 | 436,988 |
| **WORLD TOTAL EXCLUDING EASTERN EUROPE, U.S.S.R., and MAINLAND CHINA** | 2,142,120 | 393,042 | 1,218,100 | 1,590,087 | 84,179 | 641,428 | (b) 153,784 | 6,222,740 |

* Unless otherwise specified, data represent apparent domestic demand (including inland demand, refinery fuel and loss, and bunkers). Apparent domestic demand is derived from the components of refined product output, plus imports, minus exports, with no allowance for changes in stocks.

(a) Domestic demand as reported, including stock changes and bunkers; also includes, where available, liquefied petroleum gases sold directly for fuel and chemical uses from natural gasoline plants.

(b) Refinery fuel and loss in the United States data are included in residual fuel and other.

(c) Apparent domestic demand is heavily influenced by refinery fuel and losses, bunker loadings, and stock changes.

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## TRAINING FOR EMPLOYMENT

With the aim of impressing on all sections of the community the importance of the education and training of young people for employment, the Commonwealth Technical Training Week is being held throughout the Commonwealth in 1961.

In the United Kingdom the week will be held on 29 May–4 June. It is intended to stress the importance of induction and training schemes, and to give increased opportunity to young people to learn of the chances available for training and education. The organization will be in the hands of local authorities (from whom further information can be obtained) and the full co-operation of industry, commerce, and education is required. Suggested activities during the week include open days—with exhibitions, lectures, and films—in colleges and business firms; the presentation of prizes and awards at civic functions; career exhibitions and conventions; competitions and displays.

The central Advisory Committee of the Week in the U.K. has issued an explanatory booklet, *Training To-day for To-Morrow*. The secretary of the Committee is C. B. McAlpine, C.B.E., City and Guilds of London Institute, 76 Portland Place, London, W.1, from whom copies may be obtained.

TABLE IV

BUNKER OIL DELIVERIES TO VESSELS ENGAGED IN INTERNATIONAL TRADE 1959
ALL FLAGS AS REPORTED
(Thousands of barrels)

| Country | Distillate fuel oil | Residual fuel oil |
|---|---|---|
| U.S.A. ... ... ... ... ... | 11,817 | 68,845 |
| Jamaica ... ... ... ... ... | 387 | 718 |
| Panama Canal Zone ... ... ... | 2,314 | 2,211 |
| British Guiana ... ... ... ... | 3 | * |
| Colombia ... ... ... ... | 364 | 1,023 |
| Peru ... ... ... ... ... | 138 (*a*) | 202 |
| Trinidad ... ... ... ... | 5,016 (*E*) | 8,420 (*E*) |
| Uruguay ... ... ... ... | — | 911 (*b*) |
| Venezuela ... ... ... ... | 2,849 | 14,972 |
| Denmark ... ... ... ... | 1,052 | 829 |
| France ... ... ... ... ... | 2,511 (*a*) | 9,030 |
| West Germany ... ... ... | 4,959 | 7,871 |
| Italy ... ... ... ... ... | 2,881 (*a*) | 8,981 |
| Netherlands ... ... ... ... | 1,965 | 5,325 |
| Norway ... ... ... ... ... | 1,705 (*E*) | 392 (*E*) |
| Sweden ... ... ... ... | 1,604 (*E*) | 1,352 (*E*) |
| U.K. ... ... ... ... ... | 6,225 | 23,693 |
| Aden ... ... ... ... ... | 3,948 | 18,787 |
| Bahrain ... ... ... ... | 812 | 3,699 |
| Iran ... ... ... ... ... | — | 15,000 (*E*) |
| Israel ... ... ... ... ... | 72 (*E*) | 300 (*E*) |
| Kuwait ... ... ... ... ... | 294 | 18,257 |
| Neutral Zone ... ... ... ... | — | 2,200 (*E*) |
| Saudi Arabia ... ... ... ... | 914 (*a*)(*E*) | 10,879 (*E*) |
| Canary Islands ... ... ... | 1,980 | 3,431 |
| French West Africa ... ... ... | 3,100 | 8,700 |
| Kenya ... ... ... ... ... | 167 | 740 |
| U.A.R., Egypt ... ... ... ... | 491 (*a*)(*E*) | 1,901 (*E*) |
| Australia ... ... ... ... | 1,561 | 5,473 |
| British Borneo ... ... ... ... | — | 1,066 |
| Ceylon ... ... ... ... ... | 341 | 2,565 |
| India ... ... ... ... ... | 1,000 (*E*) | 1,880 (*E*) |
| Indonesia ... ... ... ... | 667 (*E*) | 2,778 (*E*) |
| New Zealand ... ... ... ... | 490 | 1,067 |
| Thailand ... ... ... ... | — | 402 (*b*) |
| South Vietnam (incl. Cambodia) ... | 10 | 25 |

* Insignificant.
(*a*) Includes other, such as aviation gasoline and lubricants.
(*b*) Includes undetermined quantities of distillate fuel bunkers.
(*E*) Estimates based on latest available data.

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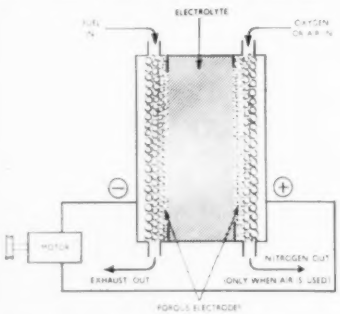
## MORE POWERFUL FUEL CELL ANNOUNCED BY SHELL

A low-temperature fuel cell that can generate from three to five times more power per unit volume than other similar cells under development was announced on 3 August by Dr C. G. Williams, director and general manager of "Shell" Research Ltd. This development, by Shell's Research Centre at Thornton, Cheshire, is regarded as a significant step forward in making these devices practicable.

"Shell's interest in the fuel cell," Dr Williams said in a statement, "stems from the fact that the oil industry is a supplier of fuels and no one has yet decided just what kind of fuel will best suit the fuel cell of the future.

"When burned in a steam turbine or automotive-type engine, 60–85 per cent of the energy in the fuels they run on is lost as waste heat. By converting the energy of a fuel directly to electricity in a fuel cell without using a heat engine this waste is reduced to 20–30 per cent.




*The new fuel cell developed by Shell Research Centre*

"Thus, the development of a practical fuel cell can increase the efficiency of producing energy by reducing losses and thereby contribute to solving the problem of how to meet the world's ever-increasing demand for energy."

*The picture shows an experimental fuel cell of advanced type under study at Thornton. This cell of 20 units is producing 50W of power at 250° C. Whilst in this laboratory model the end plates are made of mild steel, plastic could be used for this purpose resulting in a very considerable weight reduction. Dr D. P. Gregory, member of the Thornton Research team working on fuel cells, is sampling the electrolyte in the cell*

Other possible advantages of the fuel cell are reduced atmospheric pollution from exhaust gases and less noise. If the technical problems of developing the fuel cell are successfully overcome it is possible, therefore, that its use will be widespread.

The high output of Thornton's fuel cell results from the fundamental studies Thornton has made of fuel cell electrodes. This work has led to the development of inexpensive and easily-fabricated electrodes that are highly active. Development work has been carried out using hydrogen as the fuel, but the cell has demonstrated its ability to use other fuels and further work will be carried out in this direction. The cell can operate with either alkaline or acid electrolytes. When run on hydrogen and oxygen at pressure of 3 psi, current densities of 70 A/sq ft can readily be obtained with both types of electrolyte at room temperature. If air is substituted for oxygen, there is little loss in performance. As the cell warms up to 60 C, the output is doubled. Power per cu ft is 3–5 kW.

In discussing the electrolyte, Dr Williams said that the acid cell has a major advantage because it is free from troubles due to carbon dioxide. This gas, which is present in air and also in fuel gases derived from hydrocarbon fuels, destroys the activity of the electrolytes.

"Shell" has constructed multiple fuel cells with up to six cells per inch, and believes that units having a power-to-weight ratio of 50 W/lb are realizable.

Although this research shows that real advances in fuel cell design are possible, "Shell" Research does not, at the moment, intend to construct larger units as it is considered too early to predict the lines along which fuel cells will be developed.

# Notes of the Month

### Further Progress at Milford Haven Oil Port

The first BP supertanker to use the Company's new £6½ million deep-water oil terminal at Angle Bay, Milford Haven —the 42,000 dw ton *British Statesman*—arrived at the end of August with a cargo of crude oil from the Middle East. A total of 39,000 tons was unloaded into the storage tanks at Kilpaison tank farm, one-and-a-half miles away on the southern shore of Angle Bay. The crude was later pumped through the 60-mile pipeline across South Wales to Llandarcy refinery.

British Statesman *being manoeuvred into position by tugs on her arrival at the jetty at BP's Angle Bay Terminal*

This is the second initial tanker unloading to take place in Milford Haven in the last two months, for it will be remembered that the first crude oil for the new 5 million tons year Esso refinery on the north side of the Haven was brought in by the *Esso Portsmouth* on 8 July. During the unloading of the 32,000 tons of Kuwaiti crude oil a series of explosions occurred which resulted in a fire.

The arrival of the *British Statesman* marked the commissioning of the BP terminal, on which construction work was begun late in 1957. The Victorian fort at Popton Point was reconstructed to accommodate bunkering tankage, ancillary equipment, and essential services, thereby helping to retain the splendour of this unspoilt coastline. The 2500-yards long "T"-shaped jetty head is capable of berthing 100,000 tons of shipping at a time.

### Shell Expansion in Central America

Marketing companies of the Royal Dutch/Shell Group are being established in El Salvador, Honduras, Nicaragua, and Costa Rica as part of a programme of expansion in Central America.

To supply these companies with products a £3,500,000 refinery will be built at Acajutla, in El Salvador, some 50 miles from the capital, San Salvador. Construction work will begin shortly. This will be the second refinery in Central America, the first now being built in Guatemala.

Until now Group companies have operated in only three Central American countries: in Guatemala and British Honduras, where associated companies are carrying out exploration activities as well as marketing, and in Panama where activities are limited to marketing. Elsewhere in the region Shell products have been sold for some years by agents.

Inland oil trade in Central America (excluding Mexico), which amounted to some 1,500,000 tons a year at the end of 1959, is increasing at an annual average rate of about 10 per cent.

Refinaria Shell El Salvador SA, a new Salvadorean associate of the Group, has been formed to construct, own, and operate the refinery, which will be the first in El Salvador. It will have a distillation unit, a catalytic reformer, and a hydrogenation treater. Its capacity will be 500,000 tons a year.

### Long-Distance Ocean Pipeline Tow

A powerful sea-going tug boat drawing a 200-ft barge, its decks loaded down with pipeline equipment, made a lonely 7500-mile voyage in August to the tip of Argentina. Its object was to lay six miles of pipeline and to construct an offshore loading anchorage so that the oil off the island of Tierra del Fuego can be exported to world markets.

The tug and barge were owned by Brown & Root Inc, of Houston, who will do the construction for Tennessee Argentina SA, a subsidiary of Tennessee Gas Transmission Company of Houston. Tennessee Argentina has a contract to conduct oil and gas exploration and development for Yacimientos Petroliferos Fiscales (YPF), the government-owned company, on approximately 3,500,000 acres of Argentina's portion of the island.

It was estimated the trip would require over 60 days to reach the construction site. From Houston, the trip would be considerably shorter by going through the Panama Canal and down the west coast through the Straits of Magellan; but it was thought that the currents were so swift from east to west in the Straits that the longer course had to be taken. The tug *F. R. Hauber* would take advantage of these currents on the return trip and sail up the west coast of South America.

The tow is believed to be one of the longest open-barge tows ever to leave the North American continent. The *Hauber* was loaded with 29,000 gallons of fuel oil when she left Houston but still required six refuelling stops on the way.

An immense amount of food and supplies for the 11-man crew had to be stowed aboard for the long trip. Every conceivable piece of equipment and supplies on the barge had to be crated, waterproofed, and lashed securely. These included draglines, all the welding equipment, anchors, chains, and other paraphernalia necessary for marine lines. Also on board were enough spare parts to rebuild a Diesel engine should the *Hauber* have trouble. The five-month, 13,000-mile trip was necessary because the island of Tierra del Fuego has no harbour facilities for tankers and the oil had to be loaded by means of an offshore line.

*The lay-barge in operation*

### BP Marketing in Canada

BP now has 700 retail outlets in Canada. The latest extension to the network is in northern Quebec where BP Canada Ltd has recently signed a marketing agreement with a large local distributor centred on Maniwaki, about 70 miles north of Ottawa.

It is just over three years since BP entered the Canadian retail market and in that time the Company has established an extensive chain in the Provinces of Quebec and Ontario. BP Canada Ltd is also steadily building up through distributors its market for the heavier stove and furnace oils. These outlets are serviced by bulk plants located at strategic centres throughout the marketing area.

BP's new 1 million tons year refinery at Ville d'Anjou, near Montreal, was recently commissioned and is now supplying products.

### New American CLR Engine Test Equipment at Monsanto

Monsanto Chemicals has now supplemented the engine test equipment at its technical service laboratories, Newport (Mon.) by the installation of a CLR (Co-operative Lubricants Research) oil test engine manufactured by the Laboratory Equipment Corporation, Mooresville, Indiana. This engine has initially been set up to perform the CRC L.38 bearing corrosion and oxidation stability test which now forms part of the Americam MIL-L-2104A specification, replacing the obsolescent Chevrolet L4 test.

The equipment includes the necessary modifications for adapting the engine to carry out the proposed CRC L.43 test, which is designed to evaluate the low-temperature sludging characteristics of lubricating oils. It is understood that these two tests, together with a newly-developed diesel detergency test using the Caterpillar 1-G diesel engine, will form the basis of a revised MIL-L-2104A specification in the near future.

The Monsanto CLR engine facilities are expected to be approved for use under the present MIL-L-2104A specification by the U.S. Ordnance Department Engine Review Committee at their next meeting.

In the U.K., the Chevrolet L4 test becomes obsolete on 1 January 1961, after which it will be mandatory to use a Petter W1 engine test procedure. The Monsanto laboratories are fully equipped with both the Petter W1 and AV1.

### SONJ Statistics—First Half 1960

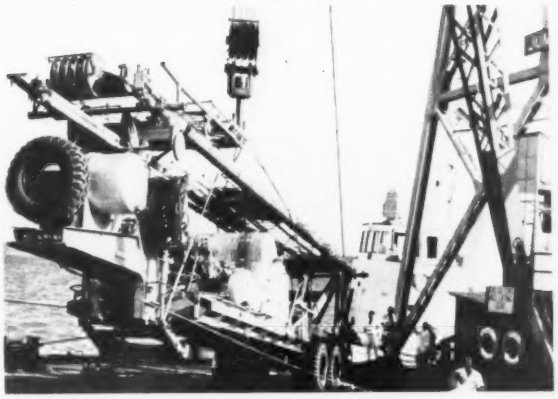
Gross crude oil production of the Standard Oil Company (New Jersey) Group, including natural gas liquids, for the first half of 1960 is estimated at 2,519,000 bd, as compared with 2,515,000 bd for the corresponding period of 1959. Refinery runs averaged 2,835,000 bd—an increase of 52,000 bd over January–June 1959.

### Drilling in Upper Assam

Drilling began at Well No 13 in the Moran oilfield, Assam, on 17 August. Of the 12 wells already drilled in the area by Assam Oil Co. eight have been proved as oil or gas producers.

Drilling is also continuing at Nahorkatiya, where 67 wells have so far been completed. The latest completion was drilled in 10 days, and preparations for drilling are going ahead at two further sites.

### Test Wells in Kenya



*The 35-ton Forasol drilling unit being unloaded by floating crane on arrival at Mombasa*

BP-Shell Petroleum Development Company of Kenya is to drill a series of medium-depth stratigraphic holes in the Lamu area of Kenya. These wells are intended to provide geological information to compliment the seismic work being carried out in the area.

The first well was spudded-in about mid-August, at a location on the Tana River, some 30 miles south of Bura. A portable *Forasol* rig capable of drilling to a depth of 6000 ft was brought in to drill these wells.

### Hydrocarbon Oil Duty

The amount of each class of hydrocarbon oils retained for home consumption during the year ended 31 March 1960, and the net amount received in respect of duty thereon, were given on 7 July by the Economic Secretary to the Treasury.

Details are given in the following table:

| | *Quantity* | *Receipts of Duty* |
|---|---|---|
| | *Gallons* | £ |
| *Oils chargeable with Customs Duty* | | |
| Light oils: | 2,405,910,603 | 300,791,422* |
| of which motor (incl. aviation spirit) ... ... ... | (2,347,968,073) | (293,496,745) |
| Heavy oils: | | |
| For use as road fuel ... ... | 617,553,550 | 77,194,192 |
| Other (mainly lubricating oil) | 195,144,769 | 813,097 |
| *Oils chargeable with Excise Duty* | | |
| Light oils: | 96,527,393 | 6,057,809 |
| of which motor (incl. aviation spirit) ... ... ... | (33,382,037) | (2,086,903) |
| Heavy oils for use as road fuel ... | 23,135,698 | 1,445,981 |
| Total ... ... ... | | 386,302,501 |
| Allowance on certain home-produced oils used in approved refineries as raw material for chemical synthesis ... ... | | 5,348,284 |
| Net total ... ... ... | | 380,954,217 |

*Includes £51,637 in respect of light oils contained in composite goods on which oil duty was charged at a flat rate under the Composite Goods Order 1958, and for which information as to the quantity of oil is not available.

### Shell "Fish" Detects Underwater Pipelines

An underwater metal detector termed a "fish", for ensuring that the way is clear for a new hole or pipeline, is being used by Shell Oil Company in their Louisiana offshore operations.

Although information is available on the approximate position of the maze of underwater pipelines which already carry oil and gas to land locations, the "fish" is needed to locate them exactly, for they could easily be broken when something like a well jacket (which can cover over 625 sq ft and weigh up to 100 tons) is placed on a new offshore site before drilling.

Developed by scientists of the Shell Development Company, U.S.A., the detector consists of a brass hull 6-ft long and weighing 200 lb. It contains an instrument that generates an electromagnetic field which is disturbed when a pipeline or any other metal object is within range. The main advantage of the Shell detector over other models is that it works in salt water. Other devices are affected by the electrical conductivity of salt water and the high porosity brine saturated sediments which make up the Gulf of Mexico floor. Also, the Shell detector has special devices which minimize interference likely to affect its electromagnetic field, and can tell within a few inches how deep a pipe is lying under the ocean floor.

*An engineer checks the underwater metal detector before it is launched. In the background two technicians are preparing the recorder which will keep a permanent record of the detector's findings on the sea bed.*

The detector is dropped from a boat on to the ocean floor and "trolled" along behind, while a pen recorder attachment on the boat draws a straight line until the detector comes near metal on the seabed.

The plans for the brass-hulled detector were drawn up after an experimental model housed in an asbestos and cement hull had not proved strong enough to stand up to constant punishment on the Gulf floor. But before it could be assembled the Research Division at Houston received a call late on a Friday for quick assistance from a Shell survey party on a Louisiana offshore location. The party were working ahead of a contract crew laying a natural gas pipeline from a Shell offshore production platform. Divers had failed to find the large pipeline belonging to another company which lay buried on the Gulf floor somewhere in the way of the pipe-laying crew.

J. L. Arbogast, a physicist who had been working on the project under the direction of C. H. Fay, then manager of the Basic Research Physics and Mechanics Department of the Production Research Division, worked over the weekend reassembling the original cement and asbestos hull. On the following Tuesday the device was delivered to the survey party, dropped from a launch, and dragged over the sea floor where the pipeline was laid. After half an hour the recorder pen attachment on board the boat jumped away from the even line it had been drawing. An anchor buoy was tossed overboard to mark the spot, and divers sent down to investigate quickly found the elusive pipeline.

Six months later the brass hulled "fish" was delivered to the New Orleans Area, and has since proved indispensable. Interest in the detector from both outside and inside the oil industry has led Shell Development Company to apply for a patent in which Arbogast and Fay are named as the inventors.

### Fuel Supplied by Parachute

*The fuel has been loaded on to the aircraft preparatory to the flight to Windy Creek, and the pilot ties the ripcord of a parachute to the wing of the plane before take-off*

Construction workers at Windy Creek, 3500 ft up in the Snowy Mountains, in south-eastern Australia, are receiving their supplies of BP diesel fuel and lubricating oil by parachute, so that operations can continue through the winter, when other means of access become impassable.

The workers are employed by the Snowy Mountains Hydro-Electric Authority at a new dam site almost in the shadow of Australia's highest peak, 7313-ft Mount Kosciusko.

Windy Creek camp was set up late last year, when the Authority sent a party of men to carve a 16-mile road in the side of the mountains, to link Geehi Camp with the site of "M1" power station, which will be one of the largest underground in the world. As there were no access roads, all the materials and stores needed to establish the camp were carried in by helicopter. During the summer and autumn, workers received regular supplies of food and fuel by packhorse and jeep which used a track cleared by bulldozers, but with the onset of winter this track became a morass of mud and snow.

The airdrop was organized by the Snowy Mountain Authority with the close co-operation of the Royal Australian Air Force, which supplied the parachutes, and BP Australia Ltd, which supplies all the Authority's fuel requirements.

While special bomb racks and quick releases were fitted to one of its de Havilland Beaver aircraft, BP had to scour the country to collect the required number of several hundred 12½-gal drums, which are little used to-day.

### First Delivery of Butane from Coryton Refinery

*An LPG tanker is loaded at the gantries at Coryton refinery*

With the completion of the construction of a large liquefied petroleum gas recovery unit at Coryton refinery, butane has been added to the range of finished products now available from Mobil Oil Company. The unit, which has been supplying propane for some time, made butane available earlier this year.

The first delivery left the refinery by road tanker on 26 August for delivery to Henry Wiggin & Co. Ltd, of Hereford, where it will be used for the special heating requirements associated with the processing of high-quality metals.

Specially constructed filling points for loading road vehicles with butane and propane have been installed at the refinery.

### Butyl Rubber Plant for Fawley Refinery

Esso Petroleum Company Ltd is to construct a plant at the Fawley refinery for the manufacture of Butyl rubber. The new plant, which will cost about £4·3 million and which will have a capacity of 30,000 tons/year, will take an estimated two to three years to build.

Butyl rubber was discovered in an Esso research programme to develop a form of synthetic rubber which would not deteriorate. It is manufactured by reacting *iso*butylene and isoprene, and when processed exhibits excellent resistance to atmospheric aging, heat, and chemical attack. Other unique characteristics include shock and sound absorption, negligible water absorption, and therefore excellent electrical characteristics, and finally low gas and vapour permeability. As the permeability to air is only one-tenth that of natural rubber, Butyl is universally employed for the manufacture of inner tubes. The application of such a general-purpose rubber is diverse and growing rapidly.

At present all Butyl rubber is imported into the U.K. from the United States and Canada. The construction of a plant at Fawley will ease the current pressure on available supplies and assure rubber manufacturers of their future requirements of this new polymer. As an additional result the U.K. will become an exporter rather than an importer of the product.

### First Japanese Coal Tar Udex Unit Completed

The first Udex unit in Japan to separate benzene, toluene, and xylene from coke oven light oil has been completed at the Kokan Chemical Industries Company's plant at Kawasaki.

Benzene from the 500 brl-stream day UOP Udex unit will be charged to a UOP catalytic condensation unit for production of ethylbenzene. Soon to be built are hydrogenation and styrene purification units to convert the ethylbenzene to styrene.

### Firth Cleveland Group in 1959

One of the main events in the 1959 activities of Firth Cleveland Ltd, as reviewed in the Company's report for this year, was the acquisition of a 53¼ per cent interest in the Solartron Electronic Group. In addition the Broadmead retail group of radio and electrical appliance suppliers and J. J. Habershon & Sons Ltd, the Rotherham steel manufacturers, were completely bought out.

The Engineering Division of the Firth Cleveland Group reports a year of good progress. Total sales rose by 28 per cent over the preceding year—including a substantial rise in export business—and orders increased by 57 per cent.

The new Simmonds Aerocessories factory in South Wales was completed in January 1960 and is now in full production. During the year under review the Company entered into a licence agreement with Pryor Manufacturing Co. of the U.S.A. for the manufacture and sale of hydrant fuel dispenser vehicles for use in airfields. A further licence agreement was concluded with Dickow Pumpen, Germany, enabling a range of pumps of 1–6 in to be offered to industrial users.

The factory of the Solartron company at Farnborough, Hants, is undergoing a major extension and is expected to be ready for occupation at the end of this year.

### Motor Fuel Field Tests

In the Italian Alps and on the plains around Turin, Esso Research are continuing investigations into motor vehicle fuel requirements.

Laboratory work at the Abingdon Research Centre uses simulated conditions on the engine test beds, in cold and hot rooms, and on motoring dynamometers. The conclusions drawn from this work must be confirmed on the road under the most severe and varied conditions likely to be encountered by the customer. The test sites found in the north of Italy are ideal. Miles of level road in the plains with high air temperature, and long winding climbs to the heights of the mountain passes provide an arduous proving ground for the fuels designed and tested under the more clinical laboratory conditions.

The current gasoline tests in Italy highlighted the international co-operation in the Esso Group. A team headed by Dr G. Rossini of Esso Research, and made up of technicians from France, Germany, Italy, and Britain have been working with cars from five European countries. In all, 12 different models were used.

*Dr Rossini discusses the test programme while some of the cars are warmed up at the start of the days work*

# The Ownership of World Refinery Capacity

World refinery capacity at the end of 1959 was at a level of 1,168,665,000 metric tons. Of this total 15·6 per cent was under British or British-Dutch ownership, according to information published by the Petroleum Information Bureau. United States interests owned 667,285,000 metric tons, or over 57 per cent of world capacity; the remaining 319,215,000 tons—over 27 per cent—being held by other interests.

The total at the end of 1959 was a rise of 8 per cent over that announced a year previously. The share of refinery capacity in the United States in the 1959 total was 492,715,000 tons, or 42 per cent of the world. Estimated refinery capacity in the Soviet Union was 125 million tons, whilst Venezuela with 47,910,000 tons and the U.K. and Canada, with capacities of 42,710,000 tons and 42,150,000 tons respectively, were next in order of size. After North America, Western Europe was the area with the largest total refinery capacity, its figure of 189,060,000 tons being 16 per cent of the world aggregate.

A comparison with the division of world refinery capacity in 1955 shows that the share of the various sectors of ownership has changed only very slightly. The world total itself has increased by 34 per cent since 1955. Within this rise each of the areas has increased their totals, and several countries now having refinery capacity were not refining nations in 1955. Full details can be seen in Table I.

A particularly interesting comparison may be made when comparing the 1959 statistics with those for 1952. Although such detailed statistics as those in Table I are not readily available for the latter year, it will be seen from Table II that the world refining capacity total in 1952 was 683,395,000 metric tons. Of this British or British-Dutch interests held

TABLE I

OWNERSHIP OF REFINERY CAPACITY*
(Thousand metric tons—at year end)

| Country | 1959 | | | | 1955 | | | |
|---|---|---|---|---|---|---|---|---|
| | *British and British Dutch* | *U.S.A.* | *Others* | *Total* | *British and British Dutch* | *U.S.A.* | *Others* | *Total* |
| WESTERN EUROPE | | | | | | | | |
| United Kingdom | 29,210 | 13,500 | — | 42,710 | 21,235 | 8,500 | — | 29,735 |
| France | 14,825 | 10,150 | 12,600 | 37,575 | 7,050 | 6,950 | 15,400 | 29,400 |
| Italy | 4,700 | 9,775 | 22,490 | 36,965 | 2,200 | 6,372 | 17,248 | 25,820 |
| Western Germany | 5,450 | 7,620 | 15,375 | 28,445 | 2,168 | 3,030 | 8,707 | 13,905 |
| Netherlands | 15,000 | 2,950 | — | 17,950 | 11,000 | 1,800 | — | 12,800 |
| Belgium | 2,525 | 2,165 | 3,235 | 7,925 | 1,500 | 1,250 | 2,820 | 5,570 |
| Spain | — | 965 | 3,060 | 4,025 | — | — | 2,250 | 2,250 |
| Sweden | 1,150 | — | 2,600 | 3,750 | — | — | 1,900 | 1,900 |
| Austria | 225 | 225 | 1,950 | 2,400 | 170 | 110 | 1,720 | 2,000 |
| Eire | 800 | 1,200 | — | 2,000 | — | — | — | — |
| Greece | — | — | 1,625 | 1,625 | — | — | — | — |
| Portugal | — | — | 1,265 | 1,265 | — | — | 1,250 | 1,250 |
| Finland | — | — | 1,250 | 1,250 | — | — | — | — |
| Yugoslavia | — | — | 1,075 | 1,075 | — | — | 900 | 900 |
| Norway | — | 60 | 40 | 100 | — | 55 | 35 | 90 |
| Total | 73,885 | 48,610 | 66,565 | 189,060 | 45,323 | 28,067 | 52,230 | 125,620 |
| MIDDLE EAST | | | | | | | | |
| Persia | — | — | 19,125 | 19,125 | — | — | 25,000+ | 25,000+ |
| Saudi Arabia | — | 11,300 | — | 11,300 | — | 11,300 | — | 11,300 |
| Kuwait | 4,750 | 6,250 | — | 11,000 | 750 | 750 | — | 1,500 |
| Bahrain | — | 10,550 | — | 10,550 | — | 10,250 | — | 10,250 |
| Aden | 5,000 | — | — | 5,000 | 5,000 | — | — | 5,000 |
| Egypt | 1,700 | — | 2,760 | 4,460 | 2,200 | — | 1,300 | 3,500 |
| Israel | — | — | 4,250 | 4,250 | 4,250 | — | — | 4,250 |
| Iraq | 60 | 30 | 2,635 | 2,725 | 47 | 24 | 2,129 | 2,200 |
| Neutral Zone | — | 2,500 | — | 2,500 | — | — | — | — |
| Lebanon | 240 | 745 | 140 | 1,125 | 276 | 588 | 166 | 1,030 |
| Syria | — | — | 1,000 | 1,000 | — | — | — | — |
| Turkey | — | — | 350 | 350 | — | — | 300 | 300 |
| Qatar | 15 | 5 | 10 | 30 | — | — | — | — |
| Total | 11,765 | 31,380 | 30,270 | 73,415 | 12,523 | 22,912 | 28,895 | 64,330 |
| AFRICA | | | | | | | | |
| Canary Islands | — | — | 2,840 | 2,840 | — | — | 1,500 | 1,500 |
| South Africa | — | 1,420 | — | 1,420 | — | 750 | — | 750 |
| Morocco | — | — | 150 | 150 | — | — | — | — |
| Angola | — | — | 100 | 100 | — | — | — | — |
| Total | — | 1,420 | 3,090 | 4,510 | — | 750 | 1,500 | 2,250 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NORTH AMERICA ... | | | | | | | | |
| U.S.A. ... ... ... ... ... | 30,170 | 460,110 | 2,435 | 492,715 | 28,050* | 391,950 | — | 420,000 |
| Canada ... ... ... ... | 4,780 | 31,115 | 6,255 | 42,150 | 3,800 | 11,460 | 15,440 | 30,700 |
| Total ... ... ... ... | 34,950 | 491,225 | 8,690 | 534,865 | 31,850 | 403,410 | 15,440 | 450,700 |
| LATIN AMERICA | | | | | | | | |
| Venezuela ... ... ... ... | 16,250 | 31,510 | 150 | 47,910 | 9,230 | 15,600 | — | 24,830 |
| Netherlands Antilles ... ... ... | 15,400 | 22,060 | — | 37,460 | 10,000 | 22,000 | — | 32,000 |
| Mexico ... ... ... ... ... | — | — | 19,520 | 19,520 | — | — | 16,925 | 16,925 |
| Argentina ... ... ... ... | 1,150 | 2,985 | 8,760 | 12,895 | 1,050 | 1,715 | 8,375 | 11,140 |
| Trinidad ... ... ... ... | 2,350 | 7,000 | — | 9,350 | 5,900 | 250 | — | 6,150 |
| Brazil ... ... ... ... ... | — | — | 7,635 | 7,635 | — | — | 5,540 | 5,540 |
| Cuba ... ... ... ... ... | 1,400 | 3,340 | 20 | 4,760 | — | 325 | 105 | 430 |
| Puerto Rico ... ... ... ... | — | 4,540 | — | 4,540 | — | 525 | — | 525 |
| Colombia ... ... ... ... | — | 1,760 | 1,750 | 3,510 | — | 410 | 1,750 | 2,160 |
| Peru ... ... ... ... ... | — | 2,250 | 135 | 2,385 | — | 2,200 | 180 | 2,380 |
| Chile ... ... ... ... ... | — | — | 1,240 | 1,240 | — | — | 1,000 | 1,000 |
| Uruguay ... ... ... ... | — | — | 1,125 | 1,125 | — | — | 1,300 | 1,300 |
| Bolivia ... ... ... ... | — | — | 600 | 600 | — | — | 620 | 620 |
| Ecuador ... ... ... ... | 350 | 150 | — | 500 | 280 | — | 20 | 300 |
| Total ... ... ... ... | 36,900 | 75,595 | 40,935 | 153,430 | 26,460 | 43,025 | 35,815 | 105,300 |
| FAR EAST AND AUSTRALASIA | | | | | | | | |
| Japan ... ... ... ... ... | 1,760 | 6,155 | 20,710 | 28,625 | 625 | 3,382 | 8,783 | 12,790 |
| Indonesia ... ... ... ... | 9,840 | 3,850 | 120 | 13,180 | 7,940 | 3,250 | — | 11,190 |
| Australia ... ... ... ... | 6,650 | 5,050 | 600 | 12,300 | 5,300 | 2,820 | 510 | 8,630 |
| India ... ... ... ... ... | 3,150 | 2,800 | — | 5,950 | 2,400 | 1,250 | — | 3,650 |
| British Borneo ... ... ... | 2,500 | — | — | 2,500 | 2,370 | — | — | 2,370 |
| Formosa ... ... ... ... | — | — | 1,250 | 1,250 | — | — | 920 | 920 |
| Philippines ... ... ... ... | — | 1,200 | — | 1,200 | — | 650 | — | 650 |
| Burma ... ... ... ... ... | 455 | — | 35 | 490 | 150 | — | — | 150 |
| Pakistan ... ... ... ... | 310 | — | — | 310 | 300 | — | — | 300 |
| Total ... ... ... ... | 24,665 | 19,055 | 22,715 | 66,435 | 19,085 | 11,352 | 10,213 | 40,650 |
| U.S.S.R. BLOC | | | | | | | | |
| U.S.S.R. ... ... ... ... | — | — | 125,000 | 125,000 | | | | |
| Rumania ... ... ... ... | — | — | 13,000 | 13,000 | | | | |
| China ... ... ... ... ... | — | — | 3,000 | 3,000 | | | | |
| Eastern Germany ... ... ... | — | — | 2,000 | 2,000 | | | | |
| Hungary ... ... ... ... | — | — | 1,500 | 1,500 | | | | |
| Czechoslovakia ... ... ... | — | — | 1,000 | 1,000 | — | — | 85,000 | 85,000 |
| Poland ... ... ... ... | — | — | 1,000 | 1,000 | | | | |
| Albania ... ... ... ... | — | — | 350 | 350 | | | | |
| Bulgaria ... ... ... ... | — | — | 100 | 100 | | | | |
| Total ... ... ... ... | — | — | 146,950 | 146,950 | | | | |
| Per cent of world total ... ... | 15·6 | 57·1 | 27·3 | | 15·5 | 58·3 | 26·2 | |
| WORLD TOTAL ... ... ... | 182,165 | 667,285 | 319,215 | 1,168,665 | 135,241 | 509,516 | 229,218 | 873,850 |
| 1958 ... ... ... ... ... | 158,745 | 626,770 | 296,235 | 1,081,750 | | | | |

* Where ownership is shared the capacity is given in proportion to the shareholding.

‡ Estimated figure shown is capacity prior to nationalization.

14·6 per cent; U.S. 67·4 per cent; and other interests 18 per cent. Thus it can be seen that generally the trend in the share of ownership in the period 1952-59 has been a greatly-increased share by Government and other companies indigenous to the countries in which refineries are placed, with a large fall in the U.S. shareholding. The increase in the share of "Others" can be attributed to the changeover in ownership of the Abadan refinery, the upsurge in refinery building by indigenous companies in Italy and Western Germany, the extremely rapid expansion of the Japanese refining industry, and the rise in Soviet bloc capacity. In addition many countries have, over the past seven years, become the site of oil refineries for the first time. A breakdown by major areas in 1952 is given in Table II.

TABLE II
OWNERSHIP OF REFINERY CAPACITY—1952
(Thousand metric tons—at year end)

| | *British and British Dutch* | *U.S.A.* | *Others* | *Total* |
|---|---|---|---|---|
| Western Europe | 31,855 | 19,765 | 27,415 | 79,035 |
| Middle East ... | 7,525 | 21,975 | 1,425 | 30,925 |
| Far East ... | 10,450 | 4,645 | 3,560 | 18,655 |
| Latin America ... | 26,480 | 37,495 | 21,165 | 85,140 |
| N. America ... | 23,750 | 376,430 | 10,460 | 410,640 |
| U.S.S.R. Bloc ... | — | — | 59,000 | 59,000 |
| TOTAL ... | 100,060 | 460,310 | 123,025 | 683,395 |

# *The Outlook for International Air Transport**

*By* S. WHEATCROFT†

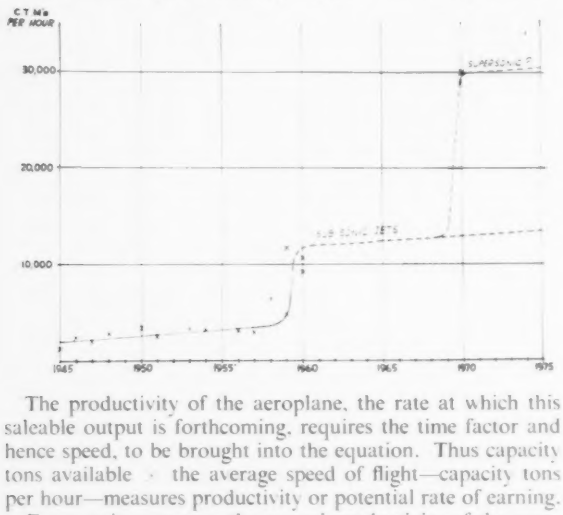
This paper will attempt to give some indications of what are thought to be current economic trends in international air transport. It will relate primarily to intercontinental air transport—the long haul side of the business—though short-haul regional operations will be referred to in passing.

**Aircraft Productivity and Traffic Growth**

The most significant economic feature in the air transport industry in the next few years will be a major upward step in aircraft productivity. This is the main theme of the paper. The fact that aircraft productivity will grow much more rapidly than air traffic trends will create some major economic problems for the airline industry, particularly in the long-haul intercontinental side of the business.

To define aircraft productivity, it is the work capacity of an aeroplane in a given period of time, and can best be measured in terms of capacity ton miles per hour. The capacity of an aeroplane can be measured by the tons of pay-load which are available for sale. This is the size factor in the equation. The saleable output of the aeroplane is the potential payload × the distance flow, *i.e.* tons × miles, and this is called capacity ton miles.

*Fig* 1
*Trends in Aircraft Productivity Capacity ton miles per hour*




The productivity of the aeroplane, the rate at which this saleable output is forthcoming, requires the time factor and hence speed, to be brought into the equation. Thus capacity tons available × the average speed of flight—capacity tons per hour—measures productivity or potential rate of earning.

For certain purposes, the annual productivity of the aeroplane, bringing the annual utilization (the number of hours of flow during the course of the year) into account, is more significant than capacity tons miles per hour. But in many comparisons, the utilization rate can be assumed to be a constant, and in such cases ctm per hour and ctm per annum are equivalent measures of aircraft productivity.

It must also be noted that productivity measured by ctm per hour will vary substantially with the stage distance over which the aircraft is operated. This is due to two factors: (a) the pay-load of an aeroplane falls as stage distance increases (because payload is displaced by the fuel required for the longer flight); (b) the average (or block) speed of an aeroplane increases asymptotically towards the cruising speed as stage distance increases (because ground times and climb times become a lesser proportion of total flight time). Hence capacity ton miles per hour, which is the product of payload and speed, is influenced both by the fall of payload and the increasing block speed of the aeroplane as stage distance increases. The curve of capacity ton miles per hour, for any aircraft, will be an inverted U-curve with productivity increasing over the short stages because of the increase in the block speed, and falling beyond a certain point as fuel displaces payload. In making comparisons between different aircraft, care must be taken to choose equivalent stage distances.

**Trends in Aircraft Productivity**

The trends in aircraft productivity over the past few years, and in the next few years, are illustrated in Fig 1. The ctm figure for the most important piston-engined aircraft used in the 1945 to 1958 period has been plotted. Each of the crosses up to 1958 represents a long-range piston-engined aircraft, and it can be seen that there was a gradual increase in productivity throughout the whole of this period, from about 1300 ctm per hour for the DC-4, up to about 3300–3500 ctm per hour for the latest generation of piston-engined aircraft, DC-7C and Super-Constellations.

As a cross-check against the slope of the trend line in Fig 1, an inspection was also made of the average figure of capacity tons miles per hour for all world airlines as reported in the IATA statistics. The average annual figures for all airlines are lower than those plotted in Fig 1 because of the influence of short-haul and feeder aircraft but the slope of the line is approximately the same for both series of figures.

After a long period of gradual growth in capacity ton miles per hour, we are now in a period of very rapid increase in aircraft productivity. This began in 1958, and it can be seen that in the turn of the decade the airlines were experiencing a very sharp increase in the productivity of their main line aeroplanes. There is very little doubt that the general level of aircraft productivity for intercontinental operations during the 1960's will be that associated with the big jets. What should be particularly emphasized here is the magnitude of the jump in aircraft productivity which is involved in the jet revolution. The industry is moving from aircraft which

*Presented to the IP Economics and Operations Group on 14 January 1960.

†Economic Adviser to BEA.

produced about 3500 ctm per hour to new ones which will produce about 12,000 ctm per hour, three-and-a-half times as great.

The probable level of aircraft productivity for supersonic aircraft has been shown in Fig 1. It has been assumed that if one were introduced in 1970, as is said to be possible, it would have a payload at least equal to that of the big jets, and it would cruise at Mach 3, *i.e.* 1800–2000 mph. Such an aircraft would thus have a productivity of about 30,000 ctm per hour, and, as will be seen in Fig 1, would represent a new major discontinuity in this trend line of aircraft productivity. The possible significance of the supersonic step will be discussed in a few remarks at the end of this paper.

**The Economic Significance of Aircraft Productivity**

In order to answer the question of why productivity is so important a brief review is required of the reasons which make it a key factor in air transport economics.

To look first at operating costs; in broad terms, one can say that there is normally an inverse ratio between operating cost per ctm and aircraft productivity. This is simply because all aircraft costs which are incurred on an hourly basis will be spread over a greater number of capacity tons miles as the productivity of the aeroplane increases. Naturally, the levels of most hourly costs are influenced to some extent by the same factors which determine hourly productivity—these two things are not entirely independent. But, very often an increase in hourly productivity can be accompanied by a less than proportionate increase in hourly cost, and therefore costs per ctm fall as the productivity of the aeroplane increases.

Analysing this further, it is worth while to look at the size and speed aspects of aircraft productivity separately. In the case of aircraft size, one can say that an increase in this parameter, and hence an increase in payload, will normally increase hourly productivity more than hourly costs. A lot of assumptions are involved in this broad statement but, adequately qualified, it can be accepted as reflecting inherent characteristics of transport aeroplanes. Hence capacity ton mile costs can be expected to be lower for large aeroplanes than small. It has been suggested, as a rough rule of thumb, that a doubling of the size of an aeroplane will normally be associated with a 40 per cent reduction in operating costs per ctm. This gives some idea of the order of magnitude of the size factor in aircraft operating costs.

The influence of the speed factor in the productivity equation is very much more complicated than that of size. It is not possible to be definite about the effect of speed on operating costs, but what can be said about it was said by Lord Douglas of Kirtleside in his Brancker Memorial Lecture three years ago. "The fundamental fact is that an aircraft's productivity increases with speed because output is the product of payload and speed. If other things are equal, higher speeds give a reduction in operating costs per unit of output. If speed increases solely because drag has been reduced, there will usually be no off-setting increase in cost. In such a case the operating costs will fall proportionately to the increase in block speed. If, however, as is more usually the case, an increase in speed comes partly or wholly from the use of more power, there will probably be some increase in cost. The question then is whether the rise in operating cost is larger or smaller than the increase in output brought about by the higher speed".* In his lecture, Lord Douglas then commented upon the influence of speed on each of the five main items of operating cost: aircraft standing charges; crew pay and expenses; maintenance and overhaul costs; fuel and oil costs; and landing charges.

A further comment should be made on the relationship between speed and aircraft operating costs, with respect to the capital cost of the aeroplane and hence the associated aircraft standing charges—depreciation, insurance, and interest.

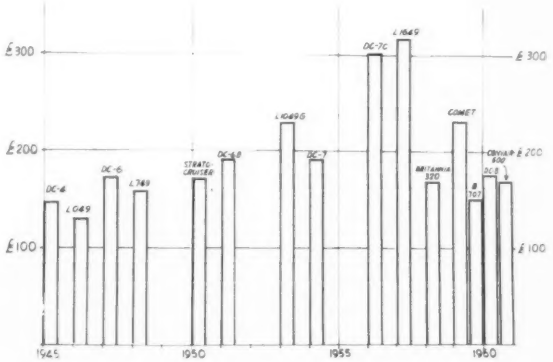



*Fig 2*
*Aircraft Price ÷ Hourly Production*

There is much talk about the prohibitive cost of jet aircraft. Certainly, at almost £2 million each, the new big jet aircraft are much more expensive than anything used previously. But it ought to be recognized that the productivity of these aeroplanes has, in fact, increased more rapidly than their prime cost.

This is illustrated in Fig 2, in which the prime costs of the same 15 aeroplanes as plotted in Fig 1 have been taken, their prices corrected to 1959 values, and then divided by the hourly productivity of each aeroplane. The figure for each aircraft therefore represents the capital cost relative to output and, if we assume the annual utilization and the depreciation period of the aeroplane is a constant factor in all cases, this relationship is a good indication of the economic burden of aircraft price. The interesting thing to be seen in Fig 2 is that over the whole of what is sometimes called the DC-4 generation of aircraft, there was a marked tendency for the capital cost per ctm produced to increase quite sharply. But with the introduction of the jet aircraft there has been a reversal of that trend, and in fact the Boeing 707 brings things back to a level very similar to that which obtained in 1945. The upward trend in aircraft price per ctm has been broken, and there is no reason for saying that the high price of jet aircraft will necessarily make air transport more expensive in the next few years.

This particular question is a good deal more complicated than the foregoing simple presentation of the problem allows, and in fact the evidence that has just been presented is to a large extent contradicted by the trends of airline operating costs. Capital costs, do, in fact, seem to be becoming an increasingly heavy burden in the airline economies.

There are two factors not directly related to the high cost of jet travel aircraft which are responsible for this contradiction. One factor is that a revolutionary change like the introduction of jet aircraft inevitably means that existing first line aircraft are relegated to second line activities. These second line activities are usually operations in which aircraft utilization

* "The Economics of Speed". *Journal of the Institute of Transport*, May 1957.

will be lower, and also in which the actual productivity of the aeroplane will be lower because it is being operated on shorter average stages. This is one explanation of the contradiction between the facts presented in Fig 2 and the reported estimates of the airlines on this matter. The other explanation is the premature obsolescence of existing fleets. The capital costs of existing aircraft have got to be met much more rapidly than was anticipated when the aircraft were bought. This factor will obviously cause the capital costs in airline accounts to be increased.

Returning to the main theme of the paper, it should be emphasized that the big jump in aircraft productivity now being experienced by the airlines is due to two factors: the increase in the speed of jet aircraft, and the increase in the size of jet aircraft. These two factors are quantitatively of about equal importance—both the speed and the size of the new aeroplanes have increased by about 90 per cent.

It is, however the size element which will have the most beneficial influence on the level of aircraft operating costs in intercontinental operations in the next few years. Without increase in size it is doubtful whether the jets would be as cheap to operate as the aircraft which they are replacing. But with the larger size of the big jets there is no reason to doubt the claims that these aircraft will have operating costs 25–30 per cent lower per ctm than the aircraft of the 1950's. This is the major factor on the credit side of the increase in productivity illustrated in Fig 1. But the potentially lower ton mile costs of the big jets are not themselves enough to guarantee the satisfactory economic progress of the industry. We must also be confident that there will be a large enough increase in traffic to make possible the realization of the cost advantages of these much larger aeroplanes.

**Air Traffic Trends**

It is in this connexion that some difficulties are likely to arise during the next few years, because of the possibility that the rate of growth of traffic will not keep pace with the rate of growth of productivity.

The past rate of growth of air traffic has been controlled by four major factors. First, the growth of wealth as measured by national income; secondly, the reduction of air fares relative to other prices, and particularly relative to surface fares; thirdly, the improvement in the quality of air service; and fourthly, the increased acceptance of air transport as a normal means of getting from one place to another. There are other subsidiary factors which have undoubtedly influenced the rate of traffic growth—the increases in populations and the increased urbanization of populations are both factors of some importance.

The question of the relative importance of these various factors may eventually be susceptible to mathematical analysis, but there is not enough information yet available to make a precise mathematical answer realistic. The author's personal assessment in terms of the percentage importance of each of these factors is that growth of national income has been responsible for about 20 per cent of the total of air traffic growth; that fare reductions have been responsible for 45 per cent; that improvements in the quality of service have been responsible for 15 per cent; the increased acceptance of air travel, 10 per cent; and all other factors combine for the remaining 10 per cent.

As a justification for this judgment one can point to the very marked correlation between the growth of air traffic in various parts of the world and national income development in those parts.

The most important factor in air traffic growth has been the reduction of air fares relative to other prices. Over the past ten years air fares relative to other prices have come down at a rate of something like 4–5 per cent each year. The traffic results achieved in various parts of the world in 1958 leave no doubt about the influence of fares. There was a general tendency for air traffic in 1958 not to grow at the fast rate at which it had been growing previously. In those areas, like the domestic United States market, where an increase in fares was made traffic growth was almost non-existent. But in Canada, just across the border, where TCA made a significant reduction in its fares, there was a traffic increase of about 12½ per cent in 1958. Similarly, on the North Atlantic route, where economy fares were introduced which represented a big reduction in the fare level, there was a large increase in the traffic volume, in marked contrast with intercontinental traffic growth in other areas of the world.

During the last ten years air traffic has increased at an average rate of about 15 per cent each year. Over the next ten years it is thought that most of the factors which have just been listed will continue to exert the same sort of influence on air traffic development to the same extent as they have over the past decade. This is particularly true of the influence of increases in national incomes, increase in quality of service (*e.g.* the introduction of jets), and the increased acceptance of air travel. The enigma would seem to be what will happen to air fares, and what will the effect of this factor be on air traffic growth.

On the basis of what has already been said about the cost reductions possible from the introduction of big jets, it is fairly certain that fare reductions equivalent to a continuation of the trend rate of the past few years will be made, at least for the next 4 or 5 years. Hence, as an optimistic prediction of the future, it can be said that air traffic will continue to increase at a rate of about 15 per cent per annum up to 1965. It would be unwise, however, to expect that trend to continue beyond that date. For this reason, an estimated increase of about 10 per cent per annum from 1965 onwards can be given. This is the basis of the upper limit of the forecast of traffic growth shown in Fig 3. Most people in the airline industry would say that this was a fairly optimistic judgment. A more conservative figure would be a growth rate of 10 per cent per annum over the whole period, and this has been shown as the lower limit of the forecast in Fig 3. The actual figures plotted are an index of traffic development based on 1958 being 100. The aircraft productivity trend from Fig 1 has also been re-plotted in Fig 3, again showing the figures as an index in which 1958 equals 100.

The divergence between aircraft productivity and traffic growth is dramatically depicted in Fig 3. From 1958 to 1962 the estimates show an increase of 250 per cent in aircraft productivity and a traffic increase of 75 per cent (taking the top line of the traffic forecast). It is not until 1970 that the traffic growth begins to catch up again with the growth of productivity. The most important thing to note is that over the past 15 years the rate of growth of air traffic has been significantly more rapid than the rate of growth of aircraft productivity. It is a major new factor that the airlines face a situation in which aircraft productivity is increasing much more rapidly than traffic growth, and it appears that this position will last for another 10 years.

**Economic Consequences**

What will be the consequences of this "big jet" step in aircraft productivity? The divergence between the two lines

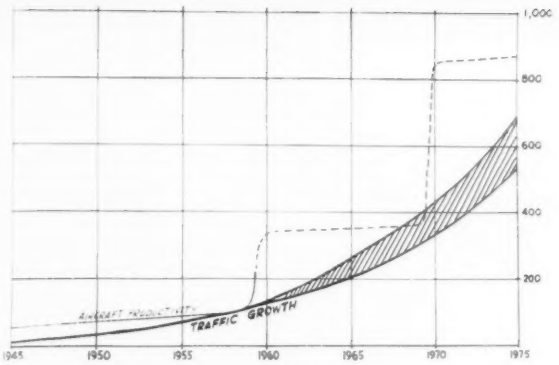



*Fig 3*
*Aircraft Productivity and Traffic Growth Trends*

in Fig 3 does have very profound economic significance for the airline industry. The two most important aspects are, first of all, that this development will create a very real problem for the airlines in maintaining flight frequencies, and secondly, that it will create substantial problems associated with smaller sizes of aircraft fleets.

The frequency problem arises from the size rather than from the speed aspect of the increase in aircraft productivity, but as has already been mentioned, these two factors are roughly of equal significance, and the industry faces an increase in aircraft size of about 90 per cent from 1958 to 1961. Maintaining flight frequencies is a matter of great commercial importance for the airlines. There is more than enough evidence to show that an airline's share of the traffic on any route, other things being equal, will be more than proportional to the frequency of flights which it offers. There is, no doubt, a limit to this, but on long intercontinental routes this limit is certainly not reached at less than a daily frequency of service. It has been the ambition of most major airlines in the past few years to establish a daily service on their most important intercontinental routes. The introduction of big jets will make it impossible for these daily frequencies to be maintained on many world routes. Here there is a danger of being misled by the North Atlantic situation, for this route is exceptional in the world intercontinental air route pattern. Most other intercontinental routes have much thinner traffic flows than this major artery across the Atlantic.

To turn to the problems of small aircraft fleets. It is apparent from Fig 3 that if by 1962 traffic has increased only by 75 per cent, while aircraft productivity has increased by 250 per cent, the airlines will only require half as many aeroplanes in 1962 as they had in service in 1958. For the biggest of the world airlines this may not create many problems, they will still require a large enough fleet of big jets to ensure that they will be able to gain all the possible advantages of large-scale operations and maintenance. There are, however, relatively few airlines in this position, as one can see by looking at the airlines' shopping list, and counting the jet aircraft which have already been delivered, or are on order by the world's airlines. Leaving aside the purely domestic U.S. airlines, there are only six world airlines which have ordered more than 10 big jets. But at the other end of the scale there is a truly remarkable number of very small orders.

It is not intended to discuss fully the economics of scale in airline operations, or, more appropriately, the diseconomics of very small scale, but it is apparent that there are very considerable problems associated with the operation of a fleet of only 3 or 4 aeroplanes; much more so with a fleet of only 2. These problems are, for example, on the operational side: the problem of reserve cover for operational delays (there must be chaos if the only aircraft in the fleet is unserviceable); and crew training (it must be very difficult to allocate an aircraft from a fleet of 2 or 3 for the purpose of training, and the alternative of using an electronic simulator for crew training would be very expensive for an airline operating on a very small scale).

On the engineering side there are equally serious problems. An airline with only 2 or 3 aircraft of one kind certainly cannot afford to have a maintenance dock with all the advantages which that sort of equipment provides in the maintenance field. There are also all the problems which arise from the need to hold adequate stocks of spares. This will inevitably be expensive for a very small fleet of aircraft, particularly the cost of holding spare major components, spare engines, and so on.

**Airline Co-Operation and Consolidations**

The basic factors in the economic situation of the airline industry at the beginning of the 1960's, whereby the increase in aircraft productivity is going to cause a situation in which many airlines will have only very small fleets of aeroplanes, and most of the airlines will have the problem of trying to maintain adequate flight frequencies, have set up a tremendous pressure towards co-operation and consolidation.

If the industry were other than one which involved all sorts of non-commercial and non-economic considerations—like national prestige—one would say that the inevitable result of these basic economic conditions would be a strong trend towards concentration. The smaller airlines would be squeezed out of business. However, it is unlikely that this would happen on any scale, primarily because of the special problems of commercial rights in airline operations. The big airlines need permits to operate from the Governments which are behind the small airlines. This is a non-commercial factor of great economic consequence in the airline industry.

The two basic problems of the jet revolution, the problems of frequency and small fleets, will be tackled by various forms of airline co-operation and co-ordination. Of these, possibly the most immediately important will be an increase in pooling agreements between airlines. The frequency problem will undoubtedly lead the companies in this direction. The recently-announced agreements between BOAC and Air India on the one hand, and BOAC and TCA on the other, are significant pointers to the future pattern. The objective of these agreements is to rationalize the schedules of the co-operating airlines so that they maintain jointly an adequate frequency of service. This is a logical alternative to the prospect that the much larger aircraft coming into service would oblige competing airlines to offer substantially excess capacity in order to maintain their own individual frequency patterns.

But the extension of pooling agreements, though these may alleviate the frequency problem, do nothing to tackle the difficulties arising from small aircraft fleets, and these problems require more fundamental types of co-operation between the airlines. One of the steps which have been taken in this direction is the arrangement arrived at between Swissair and SAS. They concluded that something smaller than the Boeing and DC-8 size of aircraft was also needed for their world routes, but, individually, neither airline could justify having two mainline jet types. This problem has been

tackled by a joint order for DC-8's and Convair 600's for these two airlines. The DC-8's will be maintained by SAS and the Convairs by Swissair, but both types of aircraft will be used for both companies.

Another development which has attracted a great deal of interest is Air Union, but although this is more spectacular—and potentially more formidable—it is not yet clear whether this agreement between Air France, Lufthansa, Sabena, and Alitalia is as immediately significant from the economic point of view as the SAS/Swissair agreement. Nevertheless, even if Air Union is only a giant pool, it is a very important development, and it may develop into a complete amalgamation of the airlines concerned. But, in the short run, it is difficult to see how Air Union will tackle the operational and technical problems of the jet period when there has been such a complete failure on the part of its collaborators to co-ordinate their orders for jet aircraft. It will be a long while before this fleet position can be rationalized sufficiently to allow real economies to be made on the technical side.

A further type of co-operation which will have great importance during the next few years is sub-contracting of maintenance and overhaul work. Many small airlines will be obliged to make arrangements with a large airline, or with a specialist overhaul organization, for the maintenance of their big jets. There are several cases where arrangements like this have already been made.

It is interesting to note in passing the way in which overhaul procedures are being developed to enable big jet aircraft to be kept more or less continually in airline service; that is to say without fairly long periods off-service for major overhauls. This is a side issue, but it is of major importance in the development of the airline business.

**Supersonic Problems**

To conclude, a word about the possibility of the supersonic step in aircraft productivity. In Figs 1 and 3 a big new step in aircraft productivity is shown with the introduction of supersonic aircraft in 1970. This has been done, not because of any conviction that such an aircraft will be in use in 1970, but because it seems the most effective way of showing the problems which will arise if such supersonic aircraft are introduced at that date. A large part of this paper has been devoted to the problems which are likely to arise in the next few years as a result of the rapid divergence of the growth trends in aircraft productivity and air traffic at the turn of the present decade. Fig 3 illustrates very clearly that the introduction of a supersonic aeroplane in 1970 would involve at least as great a divergence of these two trends in 1970 as we are experiencing at the present time with the introduction of the big jets. Before the airline industry had adjusted itself completely to the jet age it would have thrust upon it the need for an even greater re-organization, and even greater economic adjustments in operations, than those needed at the present time. Even if it is technically possible to put a supersonic aircraft into airline service in 1970, it is the opinion of the author that the airline industry could not cope economically with this development at that date. It is to be hoped that the industry will recognize this simple truth before someone goes off and orders a supersonic aircraft, and this triggers off a repetition of the jet rat-race of the last few years.

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## LABOUR STATISTICS FOR THE U.K. PETROLEUM REFINING INDUSTRY

The following figures are taken from the August 1960 issue of the *Ministry of Labour Gazette*. (cf. previous figures given in the *IP Review* 1960, **14**, 165).

*Figures in italics are the averages for all the industries covered by the tables.*

| | *Men (21 and over)* | *Youths and Boys* | *Women (18 and over)* | | *Girls* |
|---|---|---|---|---|---|
| | | | *Full time* | *Part time* * | |
| No. of workers covered by remuneration statistics ... ... | 19,870 | 965 | 997 | 470 | 29 |
| Average earnings in last pay-week in April 1960 (shillings) ... | 299·0<br>*282·1* | 149·7<br>*123·1* | 156·4<br>*145·0* | 81·5<br>*72·6* | —<br>*93·1* |
| Average number of hours worked in this pay-week ... ... | 47·3<br>*48·0* | 43·1<br>*44·2* | 42·5<br>*40·8* | 22·3<br>*21·6* | —<br>*41·9* |
| Average hourly earnings in this pay-week (pence) ... ... | 75·9<br>*70·5* | 41·6<br>*33·4* | 44·1<br>*42·6* | 43·8<br>*40·3* | —<br>*26·7* |
| | | | | *Males* | *Females* |
| Numbers employed (June 1960) ... ... ... ... ... ... ... ... ... ... ... ... | | | | 33,400 | 7,400 |
| Numbers employed (at 11 July 1960) ... ... ... ... ... ... ... ... ... ... ... | | | | 265 | 39 |

* Less than 30 hr week.

# Iraq Oil Operations in 1959

The latest annual report of oil operations in Iraq, *Iraq Oil in 1959*, has been published in both English and Arabic in one volume for the first time. It is, in addition, somewhat different in presentation and comment from its predecessors. It opens with a short explanation of the role of oil in international trade, and of the vast amounts of capital required for the healthy continuance of the business and for the administration of the ever-changing international market. The latter subject is illustrated with a chart of world oil imports and exports by areas in 1959. It shows that the net importing areas had a balance of consumption over production of the following (by tonnage): W. Europe—157 million; N. America—71 million; Far East—39 million; and Africa—16 million. In contrast the net exporting areas' balance of production over consumption in 1959 was: Middle East +199 million; Caribbean and S. America +105 million; and Soviet Bloc +16 million.

Regarding Iraq itself, production from the three concession areas in 1959 totalled 40,897,676 long tons—a new record—representing an increase of 17 per cent over the preceding year.

The breakdown of this total by fields was as follows:

| | *tons* |
|---|---|
| *IPC* | |
| Kirkuk ... ... ... ... ... | 27,027,625 |
| Jambur ... ... ... ... ... | 302,484 |
| *MPC* | |
| Ain Zalah ... ... ... ... | 908,119 |
| Butmah ... ... ... ... | 362,286 |
| *BPC* | |
| Rumaila ... ... ... ... ... | 7,870,167 |
| Zubair ... ... ... ... ... | 4,426,995 |

To handle this rise in production additional construction was carried out at all the main fields. Two new degassing stations were completed during the year at Jabalbur and Jambur, in addition to Unit No 11 of the Kirkuk process plant. Construction of the degassing stations at Bai Hassan and Qushqaye continued, and in the Rumaila field work started on the flowlines for the new Shamiya degassing station.

For the previous two years work had been in progress on the laying of loop lines to parallel the 30-in Kirkuk–Banias line over its entire length which will raise capacity of the northern pipeline system to 35 million tons/year. By the end of 1959 the 306 miles of sections from the Iraq border to the Mediterranean had been completed, except for a final 21-mile stretch to Banias terminal and a further 38-mile bifurcation to Tripoli terminal. In Iraq itself preliminary work was begun on the 249 miles of loops from Kirkup to the frontier.

Construction of the new terminal at Khor al Amaya, 25 miles south of Fao, progressed steadily. Two of the three platforms for the £16 million terminal were built in the U.K. and towed some 7000 miles to Fao, where preliminary work on them in the last quarter of the year was completed to make them ready to be towed to the terminal site. At the same time construction on shore was going ahead on two 32-in pipelines, 25 miles in length, from the existing installation at Fao to the new terminal. By the end of 1959, 17 of the total 18 miles of sealine and 6 of the 7-mile landward section had been welded. When the whole project is completed, which should be in the latter part of 1961, the productive capacity of the southern fields will have been raised to some 22 million tons/year. Oil exports during the year totalled 38,803,000 tons, of which 81·5 per cent went to W. Europe, 4 per cent to the U.S.A., and 11·5 per cent to the Far East.

During the year under review extensive exploration was carried out in all three areas, under the new exploration headquarters in Baghdad.

Total drilling footage in all areas was 138,459, compared with 88,525 in 1958. The number of wells completed was 23—of which 11 were completed as producers—as against 14 in the previous year. At Kirkuk, a further 9 producing wells were completed, and 4 wells for the injection of water from the Lesser Zab River into the reservoir were also drilled. When completed this will be the biggest water injection scheme in the world. At Bai Hassan two further appraisal wells were drilled. At Jambur, one oil producer was completed, and in addition two exploration wells were completed to the south-east: an unsuccessful one at Pulkhana, and one at Gilabat where a second test well was commenced at the end of the year.

The MPC concession continued to be disappointing. No new reservoir of importance was found, but an additional producer was completed in the Ain Zalah field.

In the BPC area drilling activity increased, and a new producing well came in at Rumaila. Drilling at Samawa, on the Euphrates, was abandoned after the location of only traces of oil and gas; and a well at Tuba, between Rumaila and Zubair, was being tested at the end of the year. Three other wells, one at Kifl and two at Rumaila, were still drilling.

Further progress was made during 1959 in introducing Iraqi personnel into senior positions in the Company, so that by the end of the year 50 per cent of the people in such grades were Iraqi. Trade unions were also formed during the year.

The country's revenues from oil amounted to £86,556,875, as opposed to £79,900,000 in 1958.

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## MIDDLE EAST OIL PRODUCTION

| | *July* | *Jan-July* |
|---|---|---|
| | *Tons* | |
| Iraq Petroleum Co. Ltd ... ... | 2,903,441 | 18,750,751 |
| Basrah Petroleum Co. Ltd ... | 619,676 | 6,674,042 |
| Mosul Petroleum Co. Ltd ... | 113,900 | 762,321 |
| Qatar Petroleum Co. Ltd ... | 691,957 | 4,698,801 |
| Iraanse Aardolie Exploratie en Productie Mij ... ... ... | 3,896,000 | 27,906,000 |
| Kuwait Oil Co. Ltd ... ... | 7,161,898 | 46,195,016 |
| | *Barrels* | |
| Arabian American Oil Co. ... | 37,139,763 | 259,003,901 |
| Bahrain Petroleum Co. Ltd ... | 1,399,316 | 9,600,786 |
| Getty Oil Co. and American Independent Oil Co. (Kuwait-Saudi Arabia Neutral Zone) ... | 4,049,723 | 27,509,166 |

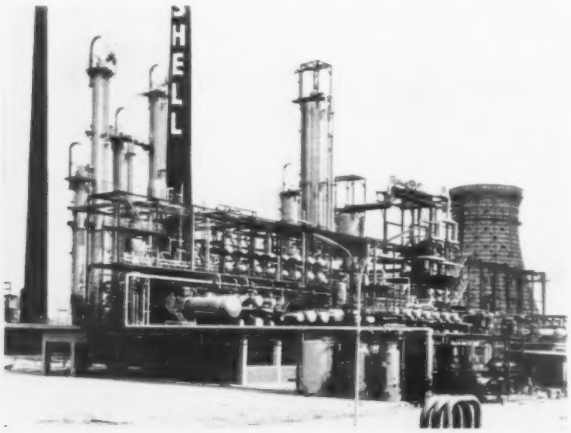
The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for July was 1,460,000 tons, the total for 1 January to 31 July being 9,648,000 tons.

Crude processed at Aramco's Ras Tanura refinery during July was 5,346, 327 brl, the total for 1 January to 31 July being 46,316,009 brl.

# New Shell Refinery Opened in the Ruhr

Deutsche Shell's new refinery at Godorf, near Cologne, was officially opened on 15 July by Professor Siegfried Balke, Federal Minister for Atomic Energy.

Work was begun on the site in the autumn of 1957, and to complete the project over 35 million cu ft of earth had to be moved, and more than 11 miles of roads were built. A total of 373 miles of pipelines and 5 miles of railway track were laid, as well as 2 new bridges for the connexion of the refinery to the railway. The maximum number of employees working on the site was attained in the autumn of 1959 with 1300 workers.




*Part of the distillation unit at Godorf refinery. In the background right, is the water-cooling tower*

The refinery, which covers an area of 568 acres, will initially process some 2·5 million tons year of crude oil, but will attain its full annual crude capacity of 4 million tons within a very short time. The following units have been erected:

| | *Tons year capacity* |
|---|---|
| Crude oil distillation ... ... ... | 4,000,000 |
| Platforming plant ... ... ... | 435,000 |
| Desulphurization plant ... ... | 1,825,000 |
| Sulphur recovery plant ... ... | 11,000 |

The division of product output will be as follows:

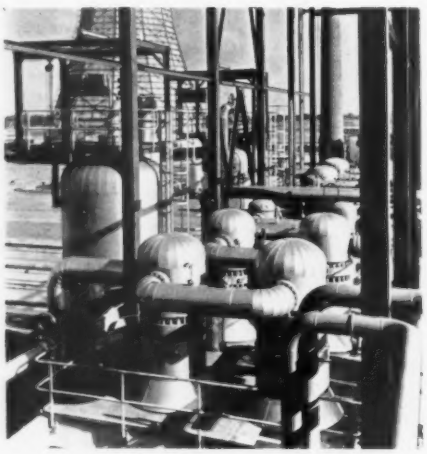
| | *Per cent* |
|---|---|
| Aviation turbine fuel ... ... ... ... | 2 |
| Motor fuel ... ... ... ... ... | 13 |
| Diesel oil ... ... ... ... ... | 13 |
| Fuel oil ... ... ... ... ... ... | 55 |
| Liquefied petroleum gas ... ... ... | 3 |
| Feedstock for chemicals ... ... ... | 7 |
| Own consumption and supplies for other Shell plants ... ... ... ... ... | 7 |

Crude oil for the refinery will be supplied from Rotterdam via the 24-in pipeline to the Ruhr operated by the NV Rotterdam-Rijn Pijpleiding Mij. The ownership in the latter company is Bataafse Petroleum Mij (Royal Dutch/Shell) 40 per cent, Gelsenberg & Mobil Oil Handels-und Transport GmbH 40 per cent, and the California Texas Co. 20 per cent. The capacity of the line is at present 8 million tons year and it can be increased by the addition of further pumping stations to 20 million tons year. The line is over 155 miles in length from Pernis, Rotterdam, to Godorf and Wesseling, with a further 28-mile branch line from Venlo to Wesel.

At the refinery, four crude oil storage tanks with a total capacity of 19 million Imp gal have been installed, and two further tanks which are now under construction will, when completed, bring the crude oil storage capacity to over 33·5 million Imp gal. For finished and intermediate products 50 tanks of 67·2 million Imp gal have been erected, and 18 horizontal pressure vessels of over 7000 cu ft capacity each are for the storage of liquefied petroleum gas. The latter storage has an earth cover of over 3 ft thick to protect it from sunlight.

Cooling water requirements of the refinery are 2 million gal/hr. This will circulate through the cooling towers within the refinery so as to keep withdrawal of ground water to a minimum and to avoid contamination of the Rhine. Steam requirements are produced from the refinery's own boiler house in two boilers with outputs of 50 and 25 tons/hr.

The bulk of the finished products are loaded at Godorf docks, which have been adapted by the Cologne-Bonn railway to be used as a loading station for petroleum products. Six of the 12 berths planned for ships of up to 2000 tons have been installed. The remainder of the finished products are transported by road or rail. Approximately 100 rail tank-cars and 200 road tank wagons can be despatched per shift.



*Part of the hydrodisulphurization unit at Godorf refinery*

**COUNCIL ELECTIONS 1961**

Members are reminded that, under By-law 72, all nominations for the Council Elections in 1961 must be received by the General Secretary not later than 31 December 1960.

Applications must be made on the special Council Election form, proposed by a corporate member, and supported by six corporate members. Forms are obtainable from the General Secretary.

# Correspondence

## PETROLEUM HISTORY

To the Editor, the *Institute of Petroleum Review*.

Sir,

On my retirement from active participation after over 50 years in the petroleum industry, I turned to the study of historical records and prepared to settle down to a methodical system of research into the subject that had absorbed me over the years. I thus came to have both time and inclination just when a flood of historical books, papers, and articles in the trade and scientific journals appeared to entertain and instruct readers as to the causes of the "centenary celebrations".

A study of most of what was published during 1959 led me to the conclusion that certain aspects of history were becoming a shade distorted, and by referring to original early documents as well as the writings of petroleum savants and historians of earlier days it soon became clear that suspicion of inaccuracies in these recent writings was apparently well-founded.

In this letter I only wish to take up one of these many facets of the mineral oil industry because it may interest many of your readers who are unable to give time to making historical researches on their own account. I refer to the very beginnings of the industry in the United Kingdom and the work of James Young, which was initiated years before 1859.

The *IP Review* fully reported the well-remembered Young Memorial Lecture delivered to the Scottish Branch on 8 January 1948 by Edwin M. Bailey. Later an article was contributed by Bailey (Vol 2, No 24) giving an historical outline entitled "The Dawn of Petroleum Refining", on page 359 of which he wrote that the famous Bathgate Works "at first manufactured naphtha and lubricating oil. Paraffin oil for burning and solid paraffin were not sold until 1856, and the demand for it only became considerable in 1859".

An almost identical passage had appeared in the report of the Memorial Lecture, and since it appeared in the article with quotation marks it might be that Bailey intended it to be taken as quoting James Young's own words. Whatever his intention—and his sole aim was to bring out the true facts—subsequent writers on early oil history have used the passage as authentically establishing that Young's works did not market burning oil or paraffin wax until the year 1856, and the output before that year was restricted entirely to naphtha and lubricating oil. In March 1955 a monograph by Beaton said that Bailey's material "which has not been previously noticed by scholars writing on Young . . ." in America proved in Young's own words that Young had not been the first manufacturer of mineral burning oil. In 1959 *World Petroleum* published a similar article and other historians repeated the conviction.

The truth is that Young started to manufacture and sell burning oil as early as 1848, but that was not at Bathgate; it was at the famous spring of petroleum in Derbyshire where he built a works for the purpose. In his sworn evidence at Court on 3 March 1864, Young's words as reported in the Law Reports, etc., were as follows:—"In carrying on the works at the petroleum spring we made from it two oils; one was *sold* for lubricating machinery; the other was *sold* for burning in lamps. It contained a small quantity of paraffin which we separated as a curiosity; but we never made so much as to make it merchantable". So much for the burning oil from petroleum.

Very definite proof that Young started manufacturing and marketing such oil at the Bathgate works in 1851 can be provided from sworn evidence and actual figures handed into Court by a certain John Paynter. He had been a partner with George Miller in that Glasgow (and Aberdeen) company that figures largely in fables concerning Young, which cannot be dealt with in this letter. Paynter handed in the records of this Miller & Co. when giving evidence against Young and not for him. He showed exactly what the company had purchased from Young's company and said.

> "We had extensive operations with Mr Young's firm. We began in 1853 and ended (the contract) in 1856. . . . In the year 1853 we bought from Messrs Young, 2179 gallons of naphtha and 4686 gallons of burning oil; in 1854 we bought 7494 gallons of naphtha and 2351 gallons of burning oil; in 1855 we bought 23,407 gallons of naphtha and 3959 gallons of burning oil; and up to May in 1856 we bought 12,128 gallons naphtha and only 1806 of burning oil. The lamp we sold for burning the oil in is called Beal's . . ."

Paynter added that Beal's lamp had been known before 1850. He went on to explain that when the contract with Young ran out in 1856 he went along to see John Young in Glasgow (who was the selling agent for his brother) and asked to have the contract renewed, but John Young refused to do this "saying they had found a better market for the oils in Germany. He told us the simple fact which we already knew, that they would call it *Paraffine Oil*." Then Paynter made the complaint "the oil we had been buying, in point of fact contained no paraffine", meaning wax of course.

From these figures it can hardly be claimed that Young failed to market burning oil for lamps before 1856. What the sworn evidence proves is that Young commenced to employ a brand name from 1856, namely *Paraffine Oil*. Incidentally Young was questioned as to why he had changed the name but his reply was that there had been no change; the wording of his 1850 patent clearly said "This I call Paraffine Oil" from which he obtained paraffine. He had merely made the businesslike decision in 1856 to use a brand name and that was it.

One could furnish very many interesting facts from those old Court records. Able writers in Scotland have known all along that there were no works records still in existence at Bathgate. The recorded story (in Court) of how and through whom the solid paraffin was first introduced to the market is also fascinating. Amongst other things is a record of the Boghead cannel coal purchases and how "Mr Young paid for it each month as delivered."

I should be very interested to learn whether other readers of the *IP Review* have found recent historical accounts somewhat inaccurate, and have felt that an attempt to correct the trend is overdue.

Yours faithfully,
Owen Colverd.

29 *Myahgah Road; Mosman,*
*New South Wales, Australia.*
17 *August* 1960

# *U.K. Petroleum Statistics 1959*

The 1959 edition of the annual Ministry of Power *Statistical Digest* gives details of production, consumption, and utilization of all types of fuel.

In the petroleum section, extracts from which are given in Tables I and II, details are given of U.K. supplies over a large span of recent years. Statistics are given of total supplies of crude and process oils for each of the last 40 years, with a breakdown of the individual products; imports of each product according to countries of origin since 1938; and exports and re-exports of products by destinations. Each of the two latter tables have been expanded this year to include both tonnage and value according to countries of destination.

Particulars of refinery throughput and output of refined products are given annually since 1938, and in two-monthly periods for recent years, with product breakdown. Statistics are also given on the same basis for deliveries of petroleum products for inland consumption, with separate details for both Scotland and Northern Ireland. The end-use analysis of

TABLE I

| | 1957 | 1958 | 1959 |
|---|---|---|---|
| | *(thousands of tons)* | | |
| Suppliers of crude oil and shale oil: | | | |
| Imports of crude and process oils ... ... ... ... | 27,966·9 | 33,746·6 | 39,562·6 |
| Indigenous crude production | 82·0 | 79·9 | 82·7 |
| Indigenous shale oil ... ... | 71·1 | 63·4 | 60·5 |
| TOTAL ... ... ... | 28,120·0 | 33,889·9 | 39,705·8 |
| Imports of crude and products: | | | |
| Crude and process oils ... | 27,966·9 | 33,746·6 | 39,562·6 |
| Aviation spirit ... ... | 421 | 406 | 608 |
| Motor spirit ... ... ... | 1,993 | 1,956 | 2,263 |
| Other spirit ... ... ... | 276 | 126 | 121 |
| Kerosine ... ... ... | 1,490 | 1,124 | 1,299 |
| Gas oil ... ... ... | 2,099 | 1,968 | 2,088 |
| Diesel oil ... ... ... | 180 | 85 | 233 |
| Fuel oil... ... ... ... | 3,934 | 4,977 | 5,554 |
| Lubricating oils ... ... | 396 | 404 | 410 |
| Paraffin wax ... ... ... | 34 | 30 | 33 |
| Other sorts ... ... ... | 41 | 59 | 290 |
| Total refined products ... | 10,864 | 11,135 | 12,899 |
| Exports, re-exports, and bunkers: | | | |
| Crude and process oils ... | 21 | 6 | 122 |
| Aviation spirits and motor spirits ... ... ... | 1,557 | 2,046 | 1,845 (a) |
| Other spirit ... ... ... | 17 | 41 | 36 |
| Kerosine ... ... ... | 235 | 288 | 362 |
| Gas oil ... ... ... | 807 | 1,740 | 1,741 |
| Diesel oil ... ... ... | 388 | 488 | 441 |
| Fuel oil... ... ... ... | 2,816 | 3,318 | 3,260 |
| Lubricating oils ... ... | 381 | 393 | 449 |
| Paraffin wax ... ... ... | 7 | 7 | 8 |
| Other sorts ... ... ... | 80 | 77 | 80 |
| Total refined products ... | 6,288 | 8,398 | 8,222 |
| Bunkers for vessels in foreign trade and for fishing vessels | 3,476 | 3,806 | 4,059 |

| | 1957 | 1958 | 1959 |
|---|---|---|---|
| | *(thousands of tons)* | | |
| Refining operations (b) | | | |
| Throughput of crude and process oils ... ... ... ... | 27,818 | 32,933 | 39,136 |
| Output: | | | |
| Aviation and motor spirits ... | 5,908 | 6,751 | 7,531 |
| Industrial and white spirits ... | 141 | 144 | 141 |
| Kerosine ... ... ... | 839 | 1,292 | 1,672 |
| Gas diesel oil ... ... ... | 5,067 | 6,285 | 7,241 |
| Fuel oil... ... ... ... | 10,443 | 12,572 | 15,599 |
| Lubricating oil ... ... | 743 | 751 | 863 |
| Bitumen ... ... ... | 836 | 860 | 961 |
| Butane and propane ... ... | 72 | 91 | 126 |
| Other petroleum gases ... | 1 | 72 | 140 |
| Paraffin wax ... ... ... | 28 | 30 | 31 |
| Miscellaneous products (c) ... | 1,093 | 923 | 916 |
| TOTAL ... ... ... | 25,171 | 29,771 | 35,321 |
| Refinery fuel (d) ... ... | 2,091 | 2,503 | 3,032 |
| Losses and changes in unfinished stocks (c) ... ... | 556 | 659 | 783 |
| | 1949 | 1958 | 1959 |
| Overseas production by British and British-Dutch Companies (e): | | | |
| Middle East | | | |
| Iran ... ... ... ... | 26,807 | 20,325 | 23,122 |
| Iraq ... ... ... ... | 2,035 | 17,000 | 20,653 |
| Kuwait ... ... ... | 5,730 | 34,471 | 32,185 |
| Qatar ... ... ... | — | 4,052 | 3,852 |
| Africa (f) ... ... ... | 1,735 | 245 | 699 |
| Far East and Australasia ... | 6,327 | 10,289 | 11,200 |
| India, Pakistan, and Burma ... | 436 | 1,157 | 1,188 |
| Europe (excl. U.K.) ... ... | 451 | 1,017 | 1,129 |
| Caribbean and S. America: | | | |
| Argentina ... ... ... | 512 | 378 | 389 |
| Ecuador ... ... ... | 348 | 361 | 345 |
| Colombia ... ... ... | 1,090 | 1,853 | 1,901 |
| Peru ... ... ... | 361 | 504 | 477 |
| Trinidad ... ... ... | 2,880 | 2,812 | 2,974 |
| Venezuela ... ... ... | 23,780 | 42,499 | 47,700 |
| TOTAL ... ... ... | 72,492 | 136,963 | 147,814 |

(a) Comprising 976,000 tons of aviation spirit, and 869,000 tons of motor spirit.

(b) Crude and process oils comprise all feedstocks, other than distillation benzines, for treatment at refinery plants. Refinery production does not cover further treatment of finished products for special grades such as in distillation plant for the preparation of industrial spirits.

(c) Losses are estimated at 2 per cent of total throughput. The figures for miscellaneous products are obtained as a residual.

(d) Approximately 48 per cent fuel oil and 46 per cent gases in 1958.

(e) Excluding production by British companies in North America.

(f) For 1949, the figures relate entirely to Egypt. British companies' property in Egypt was sequestrated from November 1956 to June 1959.

inland deliveries of gas/diesel and fuel oils covers the years 1938 and 1952–59.

The previous edition's interesting innovation of a table of crude oil distillation capacities at the various U.K. refineries has been continued, and covers each of the years from 1953 to 1959. It is compiled from company returns, and part of it is reproduced in Table II.

A section of tables on the use of liquid fuels for burning is broken down respectively into main industrial groups; major groups by geographical regions; and use by main industrial groups in 1956, 1957, 1958, and 1959, over 8–9 week periods. In addition, stocks of liquid fuels for burning by these industries at the end of 8–9 week periods are published.

Other tabulated statistics include those on numbers of persons employed in petroleum distribution and refining respectively; capital expenditure, purchased materials and fuel used, and value of output, in petroleum and shale oil refineries; and overseas production of crude petroleum and petroleum products by British and British-Dutch companies.

The publication is issued by HMSO at a price of £1 10*s* net.

TABLE II
CRUDE OIL DISTILLATION CAPACITY AT REFINERIES

| | | 1953 | 1959 |
|---|---|---|---|
| | | *(thousand tons a year)* | |
| The British Petroleum Co. Ltd ... ... ... | Pumpherston | 180 | 180 |
| | Kent ... ... | 4,000 | 7,100 |
| | Grangemouth | 2,500 | 3,100 |
| | Llandarcy ... | 4,000 | 3,000 |
| Esso Petroleum Co. Ltd ... | Fawley ... | 7,200 | 12,100 |
| The Shell Petroleum Co. Ltd | Heysham ... | 1,765 | 1,867 |
| | Shell Haven ... | 3,287 | 7,958 |
| | Stanlow ... | 4,500 | 5,363 |
| Mobil Oil Co. Ltd ... ... | Coryton ... | 873 | 1,900 |
| Berry Wiggins & Co. Ltd ... | Kingsnorth ... | 69 | 160 |
| | Weaste ... | 56 | 140 |
| Lobitos Oilfields Ltd ... | Ellesmere Port | 115 | 200 |
| Manchester Oil Refinery Ltd | Barton ... | 125 | 150 |
| Wm. Briggs & Sons Ltd ... | Dundee (Camperdown) ... | 37 | 41 |
| | | 28,707 | 43,259 |

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# Books and Films

### OEEC Oil Statistics for 1959

The Oil Committee of the OEEC has published its oil statistics for the year 1959. The tables contained therein cover country-by-country statistics of production of natural gas, production and imports of crude oil, together with refinery throughput; total refinery output, and imports and disposal of all products; and individual tables of production, imports, and disposal (deliveries into inland consumption, bunker deliveries, and exports) for each petroleum product.

Changes incorporated in the 1959 edition compared to its predecessors are that Spain, now being a full member of the OEEC, is now included in the statistics; whilst separate tabulations are given for refinery gas as distinct from LPG. Aviation gasoline and gasoline-type jet fuel are reported separately from motor gasoline; separate information is given for gas diesel oil, and fuel oil; and petrochemical feedstocks are now included under the section "other products."

### BP Research at Sunbury

The BP Research Centre at Sunbury-on-Thames, which now covers an area of some 19 acres and employs a staff of more than 1300 men and women, was begun in 1917 with a staff of two working in the basement of an old country house.

A new illustrated booklet which has just been published by The British Petroleum Co. Ltd traces the development of the Research Centre and describes the scope of its activities. The work of the various departments, headed by the four main technical divisions—the Exploration, Petroleum, Chemicals, and Administration Divisions—are outlined, together with the role of the several subsections of each. It is explained in such a manner that the importance of the individual studies to the combined Group Research effort is readily appreciated by the outsider.

Entitled *Research at Sunbury*, copies of the booklet are available on application to BP Information Department, in London.

### "Petroleum Sourcebook 1959"

Over 5000 references to sources of petroleum information, culled from some 1500 publications and covering the year 1958, are listed in this annual publication of National Petroleum Bibliography. The references give title and bibliographical data, and relate particularly to the exploration for and exploitation of oil and gas fields. They are arranged by countries and main areas. Price of this useful bibliographical tool is $7.50, and the publisher's address is: Box 3586, Amarillo, Texas.

### Classified List of Equipment and Services

The 1960 edition of the *Classified List of Equipment and Services*, published by the Council of British Manufacturers of Petroleum Equipment, has been revised and enlarged to bring up-to-date the information in the 1959–60 edition of the catalogue *British Petroleum Equipment*. In addition, there has been a considerable extension of headings and subheadings of equipment to cover the widening scope of companies' activities.

In addition to particulars of member companies—including details of their principal products and/or services—there is the 60-page classified list itself, and a final section of trade names and specialities. Copies are available from the CBMPE, at 2 Princes Row, Buckingham Palace Road, London, S.W.1.

### Films on Loan

To group secretaries and others wishing to organize film shows for the entertainment of their members, the August issue of the *Film User* contains an extensive and most useful guide to the 16 mm films which are available on loan, mostly free of charge, from various companies and organizations. This guide occupies 16 pages, and contains upwards of 600 entries giving name and address of the company, subjects covered by the films, the scope and distribution, and the availability of catalogues and lists. Copies of the August issue of the *Film User* can be obtained from the publishers at 319 High Holborn, London, W.C.1, the price being 2*s* post free.

# *The Opening of Petrofina House*

Petrofina House, the new headquarters of Petrofina (Gt Britain) Ltd, was officially opened on 27 July last by the Rt Hon. Richard Wood, P.C., M.P., Minister of Power. Also taking part in the ceremony were HE M. van Meerbeke, the Belgian Ambassador, and Laurent Wolters, deputy chairman and managing director of the Petrofina Group. A commemorative tablet in the entrance hall was unveiled by the Minister of Power.

In his speech at the opening ceremony, C. M. Merrick, the chairman and managing director of the British subsidiary, said that the new building was a symbol of a successful piece of Anglo-Belgian co-operation, and that ever since the war Petrofina of Belgium had, in accordance with the wishes of successive British governments, been increasing its investment in the U.K. The happy and successful combination during that time of Belgian shareholders and British management and staff in Petrofina (Gt Britain) was an encouraging sign in the present atmosphere of Britain's troubles with the European Common Market. Surely this connexion might somehow contribute to the bridging of the gap that divided Britain from the Six.

On the subject of the recent marketing of cut price motor spirit in Britain, Mr Merrick remarked that it was easy enough if the price cutter had no intention of ever providing more than a minute part of the needs of British transport and industry, and if he was not going to give any real assurance of continuity of supply to the public or continuity of employment to his staff.

"The barrow boy", it was said, "with no overheads to carry, can always undersell the big stores. But however much we may admire the barrow boy as an example of individualistic free enterprise, if we want to be sure of getting something for a special occasion next month most of us will think it safer to rely on a more solidly-based supplier."

The new Petrofina House is a 13-storey building with a total floor area of 55,000 sq ft, situated close to Waterloo Station and County Hall.

As well as being the headquarters of Petrofina (Gt Britain) Ltd it houses the company's South Eastern Regional offices and two associated companies, Purfinol Ltd and Edipro Ltd, which specialize in medicinal and edible oils.

The building is in the modern office style, and has been based on the principle of providing 100 sq ft of working space for each person. Partitioning is in general use throughout, so that offices or whole departments can be speedily expanded or contracted as required. In addition to the usual departments found in the head office of an oil marketing company the building houses its own training school, lecture room and cinema, drawing offices, and a teleprinter room linking the building with the six marketing regions throughout Great Britain. Photocopying machines are installed on each floor, and there is a centralized dictating and typing service which automatically records telephone dictation for subsequent transcription. The boiler room, as well as being used for central heating and hot water supply, has been equipped with a variety of oil-firing equipment to enable it to be used by the Company's fuel oil technicians for demonstration purposes.

The architects of Petrofina House were Reginald H. Gallanaugh & Partners, and the contractors were Tersons Ltd.

*The Minister of Power unveils the commemorative plaque at the opening of the new headquarters of Petrofina (Gt Britain) Ltd*

*Seen on the platform, (left to right) are: the Belgian Ambassador, the Minister of Power, C. M. Merrick, and L. B. Wolters*

## BRITISH OIL EQUIPMENT MISSION TO SOUTH AMERICA

In March of this year an exploratory mission from the Council of British Manufacturers of Petroleum Equipment paid a two-week visit to the Argentine and Chile. The terms of reference of this four-man mission were to introduce the potential of the British petroleum equipment industry to the state industries of the two countries and the oil companies operating there; to investigate thoroughly the opportunities available in the category of capital goods; and to discuss the possibilities of credit facilities if these were required.

A most interesting report of the mission has now been published by the CBMPE, price 12*s* 6*d* net. It reviews the exploration and drilling activities now in progress in the Argentine and Chile, together with the scope and operations of the two government oil entities Yacimientos Petroliferos Fiscales and Empresa Nacional del Petroleo. The various capital projects planned in the area are itemized, and a summary of the economic situation and relevant recommendations are given. The report concludes with a list of the oil companies, contractors, and individuals met by the members of the mission, and a section entitled "general intelligence" comments on purchasing arrangements, present contracts, and the question of credit terms.

# Petroleum in Parliament

### Reference of Oil to Monopolies Commission

The President of the Board of Trade announced in a written answer on 28 July that he proposed to refer to the Monopolies Commission for investigation and report the question of the solus site system of retail sale of motor spirit in the U.K.

### Scottish Shale Oil

On 21 June a new clause in the Finance Bill on the exemption from excise duty of Scottish shale oil was debated.

It was said by John Taylor (West Lothian) that at the height of its prosperity the Scottish shale oil industry employed over 9000 people. Only five years ago its labour force was 5000, now it had dropped to less than 2500. This contraction was blamed on the Excise duty on the product which had rendered it unable to compete with other forms of oil. A few years ago it was said, the cost of the remission which was being suggested would have been about £1 million in a fiscal year: at the present time it would cost the Exchequer about a quarter of that sum, but would save the industry from extinction.

J. Hill (Midlothian) pointed out that the industry supplied four-fifths of the diesel oil for Scottish road transport. It produced 5000 tons of paraffin wax per year "which would otherwise have to be imported from America. If the industry goes to the wall it will add an estimated 10 per cent to the unemployment figure already existing in that part of Scotland. Ninety-eight per cent of the produce of the industry is of some value to this country. There is only 2 per cent waste from it." The money accruing to the Government from the tax of 1*s* 3*d* per gallon was reported to be £660,000 per year.

It was said by A. Woodburn (Clackmannan and East Stirlingshire) that the amount involved was "a mere bagatelle" in British Petroleum Company's finances. "They lost more than that in one day's quarrel in Persia."

In his reply to the motion the Economic Secretary to the Treasury pointed out that the decline in the Scottish shale oil industry had been going on ever since 1913, when the labour force totalled about 10,000. The amount of diesel oil and light oil which were the industry's main products from shale in 1959 was about 10 million gallons—"a little more than one third of 1 per cent of the total quantity of derv and light oil used in the U.K., or equivalent to less than one-ninth of 1 per cent of the total quantity of all hydrocarbon oils used in the U.K.

"The total proved reserves, estimated three years ago to be sufficient to last 25 years at the rate they were being exploited, would yield little more than one month's consumption of light oil and diesel oil used by vehicles on the roads in the U.K." The Parliamentary Secretary agreed that the existing duty preference was worth about £10 a ton of the shale oil produced in 1959. This could be compared with "the average landed cost of crude petrol in the U.K. in 1959 which was £8 a ton."

Despite the assistance, which had amounted to over £5 a week for each person employed in the industry and equivalent to a protective duty of over 100 per cent, the industry was said to have operated for several years at a heavy loss, and was uneconomic. The clause was defeated on the vote.

### Fuel Oil Imports

In an oral answer to a question from A. Fitch (Wigan) on 27 June the Minister of Power refused to consider the limiting of fuel oil imports into the U.K. So far he had found no evidence to support accusations that fuel oil was being dumped into the U.K.

Replying to a question from Woodrow Wyatt (Bosworth), the Minister repeated that in the 12 months to the end of April imports of Russian fuel oil were less than 100,000 tons. They were closely controlled by licence, and the effect on the coal industry was one of the factors taken into account before licences were granted.

Mr. Wyatt asserted that at the moment imports were running at the equivalent rate of half a million tons/year, "and the price being charged for Russian oil is only £5 15*s* a ton as against £6 10*s* by other importers." The Minister replied that Mr Wyatt's figures were incorrect, and that he would consider applying anti-dumping laws if he were convinced that dumping was taking place.

### Esso Petroleum Co. Pipeline

It was said by William Warbey (Ashfield) during the second reading of the Esso pipeline bill, on 28 June, that as the question of the development of pipelines for the carriage of bulk liquids and gases was becoming more and more prominent, it involved the necessity of inquiring how far it was being carried out in accordance with public interest and policy. "If we are not careful, before very long we might see a whole network of pipelines being developed by a number of oil companies, each seeking a controlled distribution system for its own products." He went on to say . . . "we do not want to see constructed in this country duplicating and redundant pipelines. If those which exist or are already projected have sufficient capacity to supply the need, others are not required." It was remarked that there was not "one iota of difference in either quality or price between the aviation spirit which will be delivered by Shell-Mex and B.P., on the one hand, or Esso, on the other. Everyone knows that there is no difference whatever, and, therefore, it does not matter which kind of fuel is eventually delivered to the consumer."

Mr Warbey pointed out that the Esso Petroleum Co. was a subsidiary of Standard Oil Company (New Jersey), which had over 300 other subsidiary companies. "These international oil companies make vast profits from the crude oil produced by their major subsidiaries. The major subsidiary of SONJ—the Creole Company—in 1954 had a turnover of $719 million, on which it made a profit of $240 million—in other words, a profit of 33⅓ per cent of the turnover, which is not bad going."

The subsidiary companies were said to exist only to provide commercial outlets for the oil. "They do not mind very much if Esso Petroleum, or Shell for that matter, makes only 3 per cent on its turnover. What matters to them is that Esso and other refining and marketing companies shall be able to provide continuous commercial outlets for the products on which they are making their substantial profits. What we are being asked to do in the Bill is to offer Standard Oil of New Jersey and its subsidiary in this country a controlled monopoly distribution chain." The oil companies were said to follow pricing policies such as that of "selling their fuel oil below the cost of production so as to knock coal out of the market, while compensating for their losses on the fuel oil by overcharging for their petrol and refined products. What would happen to the prices if they established a firm monopoly or semi-monopoly position in the fuel market would be very unfortunate in the end for the consumers who are at present contracting to buy fuel oil."

The speaker continued by saying . . . "that pipelines of this type ought to be owned and managed by the State and not by

private companies. I would like to see all the internal operations of the oil companies put under public ownership and control. We would then be in a position to formulate a national fuel and power policy which would be in the interest of the whole country. Short of that I would like to see these projected pipelines put under public ownership and control, so as to ensure that they would be developed according to a co-ordinated plan, in the public interest."

Airey Neave (Abingdon) referred to the economic reasons for these pipelines, underlining the big changes which had occurred at London Airport since the war. He emphasized that long-haul jet airliners required up to 16,000 gallons of fuel per plane, with a necessary turn round of 45–60 minutes. The object of the scheme was to supply the point at which such fast refuelling would be done. Estimates were that total sales of turbo fuels at London Airport, which were 6·5 million gallons in 1958, would be 100 million gallons in 1960. Mr Neave also remarked on the effect on road and river traffic if such large supplies could not be transported by pipeline—an estimated 210 journeys a day would have to be made through West London by Esso transport alone by 1964.

Francis Noel-Baker (Swindon) said that "we are very puzzled by the demand which the promoters of the Bill seem to be making that they should be given all the privileges, or many of the privileges, of statutory undertakings without any of the duties involved in the case of those public bodies. We are already concerned that the oil companies appear to be prepared to enjoy all the privileges of a monopoly position, the privileges enjoyed by private profit firms, without giving to the consumer any of the benefits of competition.

"Any motorist knows that the petrol he puts into his tank is exactly the same for all practical purposes, if he is buying the same octane rating petrol, whatever company it comes from, and I would challenge the Minister of Power to tell us whether his experts can show any difference in quality or in performance between the brands now on sale and provided by the major companies in this country." The whole system of distribution and retailing of petroleum products was said to be a monopoly position wherein quality, prices, and service were identical, "and we are being made to pay very much more for the product than we should."

"A particularly offensive example" of this present system was said to be that the oil companies were now "in a position where one individual oil company controls 93 per cent of the retail outlets." Mr Noel-Baker further explained that he was referring to the growth of the solus site system.

It was then suggested by the same speaker that one solution to the pipeline problem would be to run new pipelines along railway tracks. The railway networks served all important industrial areas and it was said that it would be a relatively simple matter to install pipelines beside main line tracks. The problem of installation "would be very much simpler than, for example, the problems involved in running the Fawley pipeline across Salisbury Plain through Wiltshire to London Airport." A further benefit of such a plan, according to the speaker, could be that British Railways might thus be provided with a valuable additional source of revenue if some payment were made to them by the interests controlling the pipelines.

Mr Noel-Baker concluded by giving the opinion that the companies which were building the pipelines should be subject to normal planning control. In his reply in the debates the Minister of Power said that the whole general problem of pipeline development was now being examined by the Government, together with the procedures which should be followed in such matters in the future. He would give a further statement when the examination was complete.

Desmond Donnelly (Pembroke) suggested that "one of the best examples of trying to enable people to safeguard their own private rights is the brochure which has been issued by the Esso Company entitled *Facts About the Proposed Esso Pipeline*". It was well produced and was an admirable example of clarity.

It was asserted by F. V. Corfield (Gloucestershire South), that the pamphlet did not give an accurate representation of the law. He further said that there should be a means of hearing minor objections to the pipeline along the route, and enabling the company to meet them. The House should also have the opportunity of considering the introduction of a general code covering the laying of pipelines.

### Measurement of Deliveries to Garages

The President of the Board of Trade was requested by G. Darling (Sheffield, Hillsborough) on 30 June to introduce regulations requiring the delivery of oils and motor spirit to garages through approved flowmeters . . . "so as to ensure that garage proprietors and filling station operators get the exact quantities they pay for."

The Minister replied that such matters would be included in the Weights and Measures Bill, which was in preparation.

### Domestic Heating

The Minister of Power said in a written answer on 30 June that he did not think it was necessary to set up a government agency to advise the domestic consumer on the use of the various types of fuel.

### Petroleum Distribution

A debate "to demand that the distribution of petrol and oil should be referred to the Monopolies Commission for examination without further delay" was introduced by George Darling (Sheffield, Hillsborough) on 13 July. It was said that the millions of motorists in Britain wanted to know a great deal more than was known at present about the distribution of petroleum products. They had paid to the garages last year a total of "about £200 million". Were the motorists getting value for that money?

Mr Darling maintained that the case for presentation to the Monopolies Commission rested on three main arguments.

First, on the size of the operating companies and their influence on the market. "There is a consortium of companies linked together in various ways and loosely called Shell-Mex and B.P. It is a group consisting of Shell-Mex, Shell Transport, the Royal Dutch Petroleum Company, British Petroleum, and National Benzole. They have working arrangements of one kind and another, but one cannot say that they are separate companies from the point of view of reference to the Commission."

The "Esso-Cleveland group" should also be looked at, it was said, and "there is a third body in this country, the Mobil Company, which is a subsidiary of the Standard Oil Company of New York. I do not know whether the Standard Oil Company of New Jersey is, under the anti-trust laws of the United States, completely separated from the Standard Oil Co. of New York. It is supposed to be. I want to know. These facts ought to be procurable."

The second argument, it was said, was the "*prima facie* case, or evidence at least, of collusion between the companies for price-fixing purposes". Recent reductions in the prices of motor spirit were instanced, and Mr Darling cited the

situation operating before the war with the "Petroleum Distributors' Committee".

The third argument was the fact "that nine-tenths of the retail outlets for petrol in this country are now tied to the petrol companies with exclusive sales agreements of one kind or another". It was said that "the oil company's representative goes along to tell the garage owner that if he does not sign he will be faced with quite unfair competition; that the company will put up a garage nearby, or that it will make an arrangement with a nearby garage, that garage proprietor being given such favourable terms that the first garage proprietor will be driven out of business. It has been suggested . . . that some representatives have told garage proprietors that if they do not sign on the dotted line they will not get petrol supplies from the firm concerned. It may be," the speaker said, "that tied garages reduce distribution costs. I have seen no evidence of this. I should like to know whether there is any evidence."

Dr Reginald Bennett (Gosport and Fareham) gave the opinion "that we are all agreed that there are monopoly conditions in this industry" and that the "rosy picture about the excellence of the distributive field is not justified by the closer investigation of some of the goings on that occur at the outlets."

The Parliamentary Secretary to the Board of Trade, in his reply, mentioned examples of the oil companies efforts to improve the efficiency of distribution: the cutting down in the number of depots, the delegation of some of the final stages of distribution to authorized distributors, the increase in the size of road tankers, and the encouraging of consumers to install larger storage capacity.

### U.K. Oil Imports

The Minister of Transport estimated in a written answer on 18 July that in the years 1955, 1956, 1957, 1958, and 1959; 40, 38, 36, 35, and 37 per cent respectively of the oil imported into the U.K. was carried in ships flying the British flag.

### Glasgow Filling Stations

It was said by the Secretary of State for Scotland, in a written answer on 25 July, that there were 324 filling stations which retail motor spirit in the City of Glasgow. It was proposed to build a further 7; and there were 8 applications still to be considered.

# Lectures, Courses, and Conferences

### The World Power Conference

It is reported that the sectional meeting of the World Power Conference held in Madrid on 5–9 June last was extremely successful, and the more than 2100 participants was a record number of any sectional meeting. The U.K. participation amounted to 241.

The Annual Report for 1959 of the Conference has now been published, and includes particulars of its work during the year; of the published proceedings of the sectional meetings held in different parts of the world over the last few years; and the announcement that the 6th World Power Conference will be held at the University of Melbourne on 20–26 October 1962.

The theme of the latter event will be "The Changing Pattern of Power". It is intended to emphasize the changes that have taken place in all forms of power production, transportation, and utilization techniques since the Fifth Plenary Meeting of 1956.

The theme will be divided into five main subjects: Energy Resources; The Production and Amelioration of Primary Sources of Energy; Transformation of Primary to Secondary Energy, and Transportation of Energy; Utilization of Primary and Secondary Energy; and Economic Evaluation of Alternative Energy Sources. The technical programme of the 6th Conference has now been issued by the Australian National Committee. Suggestions as to papers to be presented by the British National Committee of the World Power Conference should be sent to its secretary, at 201–2 Grand Buildings, Trafalgar Square, London, W.C.2.

### 1961 European Chemical Engineering Congress

The European Congress of Chemical Engineering 1961, which will take place on 9–17 June 1961, in Frankfurt-am-Main in conjunction with the Achema Congress 1961, will include the following congresses and meetings. The Achema 1961, 13th Exhibition and Congress of Chemical Engineering organized by Dechema; special meetings and lectures of the Gesellschaft Deutscher Chemiker, the annual meeting 1961 of the Dechema Deutsche Gesellschaft für Chemisches Apparatewesen, the annual meeting of the Isotopen-Studiengesellschaft, as well as the symposium on "The Physical and Chemical Durability of Structural Materials in the Chemical Industry". The invitation brochure is now available, published in five languages. Copies may be obtained free of charge from Dechema, Frankfurt-am-Main 7, Postfach.

### Irreversibility and Statistical Mechanics

The Institute of Physics and the Physical Society announces that it is arranging a conference on statistical mechanics (with special reference to irreversibility). It will be held at Queen Mary College, London, on 19–20 December 1960.

A full programme has already been arranged. The topics include the general theory of irreversibility, random processes, liquids (theory and experiment), and irreversibility in gases and in plasma.

Further information and preliminary programmes can be obtained from The Secretary, The Institute of Physics and The Physical Society, 47 Belgrave Square, London, S.W.1.

### History of the Petroleum Industry

A course of three lectures on the History of the Petroleum Industry is to be given by Professor R. J. Forbes in University College (Chemistry Lecture Theatre) London, at 5.30 p.m. on 16, 17, and 18 November. The lectures are open to those interested in the subject, and admission is free without ticket.

# Trade Literature, etc.

### Mobil Markets TML Additive in the U.K.

Following from the investigations which have been made by the Research Department of Socony Mobil Oil Co. in the U.S.A. into the qualities of tetramethyl lead additive for use in motor gasoline (*IP Review*, August 1960, 266), the new blending process is now being introduced into the U.K. under the name *Tetramel*.

Incorporated into the Mobil Oil Company's "100-octane" grade, *Super Mobilgas Special*, in place of tetramethyl lead, it is said to provide a greatly increased anti-knock quality, particularly under maximum power conditions. It has been designed as an "octane balancing" additive to ensure top-quality fuel mixture to all cylinders of an engine. *Tetramel* has a boiling point of 230 F, practically in the middle of the motor spirit range, thereby spreading its effect throughout the whole range of motor spirit constituents.

The need for such an additive for improving anti-knock quality in the middle of the motor spirit temperature range was found to be particularly applicable to the small European-type motor cars having manual transmission. Those having automatic transmission, as in the U.S.A., did not require such a product to such an extent, although TML has been sold in the U.S.A. for some months past. It is estimated that at present there is a possible market for the super-octane grade containing *Tetramel* of over 12 per cent of the cars in the U.K.

### Robot for Rocket Fuels Research

Scientists who are developing experimental rocket fuels for the U.S. Government at the Esso Research and Engineering Co. laboratories at Linden, New Jersey, have the assistance of a one-armed electric-powered robot. Believed to be the first of its type anywhere, it can manipulate delicate materials used in sensitive chemical operations at the direction of a scientist many feet away, and is powerful enough to hold 45 lb at the length of its single arm.

In its programme to develop super rocket fuels Esso Research is engaged in chemicals compounding much of which must be done remotely by scientists outside the concrete walls of test cells. The robot gives scientists a metal hand within the cells, and consists of a manipulator arm similar to those used in atomic research which is mounted on a mobile platform which can be raised or lowered the length of its steel body. Its hand works hydraulically, and the robot's hand grippers are delicate enough to squeeze a plastic bottle, turn a valve, or manipulate a slide rule.

### Air-Cooled Heat Exchangers for IPC

Head Wrightson Processes Ltd has received a large order for "Fin-Fan" air-cooled heat exchangers from the Iraq Petroleum Company. The units are to be used to cool lubricating oil from gas turbines at two pumping stations in Syria. Five larger coolers will be supplied to each station. The oil outlet temperature will be kept constant automatically with varying heat load and ambient conditions. The total installation is worth approximately £55,000.

### Mobile Radiographic Laboratory

Designed to meet the need for a fully mobile and comprehensive radiographic service, a vehicle has been introduced by B.I.X. Ltd, Hanover House, 73 High Holborn, London, W.C.1, which can be used even under the most difficult site conditions.

Fully equipped with portable X-ray equipment, radioactive isotopes, darkroom facilities, and manned by skilled operators, this laboratory offers an efficient handling of difficult inspection jobs on site.

### Desert Bridging Tanker

Designed and constructed by Saro (Anglesey) Ltd for Air BP, the 5750 Imp gal capacity bridging tanker illustrated is intended for service under arduous desert conditions. It is constructed on the semi-trailer principle, and incorporates two axle, twin-wheeled running gear, turn table for articulations, and landing gear supplied by R. A. Dyson Ltd. The tractor is a Scammell 4 × 4 Mountaineer Oilfield unit.

The tank is for conveyance of either kerosine or aviation gasoline, and is of the frameless type, divided into three compartment of equal capacity.

### Self-Levelling Greases

A new grease lubricator, the *SG*, has been introduced by Wakefield-Dick Industrial Oils Ltd.

The *SG* is designed specifically for the pumping of self-levelling greases. It has a grease capacity of 8 lb, is fitted with up to 6 outlet connexions, and can be supplied with a plain drive shaft, or the drive can be arranged through a sprocket, pulley, or ratchet. Alternatively, the lubricator can be fitted with its own worm or ratchet reduction gearbox in order to take advantage of higher driving speeds.

### Copon Coatings Marketing Transfer

Surface Protection Ltd, has transferred the marketing of the Copon range of corrosion-resisting coatings to the Copon Division of the parent manufacturing company, E. Wood Ltd, 18 London Street, London, E.C.3, whose factory is at Talbot Works, Stanstead Abbotts, Ware, Hertfordshire.

### Honeywell Micro-Switches

A comprehensive catalogue is now available in the range of heavy duty limit switches manufactured by Honeywell Controls Ltd, Ruislip Road East, Greenford, Middlesex.

### Rocol Lubricants for Rolls Royce

Rolls Royce Ltd has recommended three lubricants manufactured by Rocol Ltd, Rocol House, Swillington, Nr Leeds, for the Rolls Royce Silver Cloud II and the Bentley 'S.2' series of cars.

The products are *Moly Spring lubricant* 204*G*, specifically devised for application to leaf springs as a "life-time" lubricant, and now extended to steering linkage, track rod joints, front drag links, and intermediate lever system; *Molytone 'C' grease*, applied to expander units fitted to Girling hydrostatic brakes; and *Molytone* 265 *grease* for servo motor components, and door mechanisms, etc.

### Simmonds Aircraft Fuel Dispenser

The first of a series of aircraft refuelling vehicles manufactured by Simmonds Aerocessories Ltd, for Esso Petroleum Co. Ltd, has recently left the Company's Treforest, Glamorgan, factory.

The vehicle is capable of delivering 600 gal/min of fuel to the aircraft from the ground hydrant, and employs the Simmonds Fram water separators, Simmonds-BP shock alleviator valves, and the *Dickow* self-priming centrifugal pump.

The components system are mounted on a Rootes *Karrier Gamecock* chassis.

### Water Treating Equipment

The Mark 6 portable *Deminrolif* mixed bed ion exchanger, designed and manufactured by The Permutit Company Ltd, Permutit House, Gunnersbury Avenue, London, W.4, can convert up to 12 gallons hourly of clean cold water into demineralized water having a conductivity of less than 1·0 reciprocal megohm cm; conforming to the "Purified Water" standard of the British Pharmacopoeia, 1958.

### Honeywell Flame Detector

What is said to be the answer to all flame safeguard problems, the Honeywell *Ultra-Vision* flame detector, is described in a pamphlet from Honeywell Controls Ltd, Ruislip Road East, Greenford, Middlesex.

It can be used with all full and limited sequencing electronic relays, and will successfully control exothermic gas generators.

### Chemico Contracts in U.K. and France

Chemical Construction (G.B.) Ltd, a wholly-owned subsidiary of Chemical Construction Corp, New York, has been awarded a contract for the design, engineering, and construction of a synthetic methanol plant at the Grangemouth works of British Hydrocarbon Chemicals.

Feedstock hydrocarbon gases from existing ethylene plants will be reformed to carbon dioxide, carbon monoxide, and hydrogen in ratios suitable for the high pressure synthesis of methanol. The crude methanol will be refined by extractive distillation to produce a high-purity material suitable for use in the manufacture of resins, antifreeze, and various esters and solvents.

A similar contract awarded to the New York company is for a plant at Lyons for the production of high-purity hydrogen for Société Rhodiaceta, and which, when completed, will be one of the largest in Europe.

### Colt Ventilator for all Seasons

Colt Ventilation Ltd, Surbiton, Surrey, has introduced a new ventilator, called the O/S.R. Based on the same principles as the COLT S.R.—aerodynamic principles with aero-foil curves, producing maximum positive extraction rates under all conditions from the combined effects of stack action and wind—it can be opened up wide to the sky, thus increasing its extract capacity by approximately 50 per cent.

A new brochure of the S.R. ventilator, including details of the O/S.R., is obtainable from the manufacturers.

### New Fumaric Acid Process

A new and simple fumaric acid process for recovering fumaric values from almost any maleic containing feedstock has been announced by Scientific Design Company Inc, 2 Park Avenue, New York 16, N.Y. The process can also be used for straight fumaric acid production from prime feedstocks, and is based on moderate isomerization conditions. Among the important maleic containing feedstocks that can be upgraded are maleic scrubber solution, phthalic scrubber solution, and maleic refiner bottoms. Prime feedstocks include benzene and butenes.

### Miniature Potentiometric Recorder

A new miniature potentiometric recorder (MR 1035) has been produced by Firth Cleveland Instruments Ltd, Stornoway House, Cleveland Row, London, S.W.1, occupying a minimum of panel space and maintaining the accuracy of larger instruments.

It presents a continuous line pen record on a 3-in wide calibrated chart whose life is one one month at 1 in/hr. Six chart speeds are available, and there are six standard ranges for minimum span sensitivity. Accurate to ± 0·5 per cent of full span, or ± 10 microvolts, whichever is the greater, its sensitivity is 0·1 per cent or 5 microvolts, whichever is the greater, and its stability within 0·3 per cent.

### Low-Cost Infra-Red Spectrophotometer

Unicam Instruments Ltd, Arbury Road, Cambridge, announces the introduction of its SP 200 infra-red spectrophotometer. Only one operating control is used when the instrument is set up, and long-term reliability has been a special feature of the design. Its low cost is said to open up the field of infra-red analysis to a wide section of science and industry previously unable to justify the technique.

### Multiplex Installation at Purfleet

The flexibility of GEC *Multiplex* equipment has been illustrated at Esso's Purfleet plant in a novel application in the field of oil pump control.

The ten road tanker bays are served by five two-speed motors at the tank farm. The *Multiplex* circuit is so arranged that an integrating unit senses the number of bays requiring oil delivery and remotely switches on the appropriate pumps at the correct speed to maintain a pre-determined pumping pressure. As additional tankers arrive or loaded ones drive away, adjustments are automatically made to the pump settings.

The control signals are in the form of *Multiplex* voice frequency tones, many of which can be passed simultaneously over a single pair of wires.

### Mobile or Static Fuel Dispenser

Built by E. & E. Pump Services Ltd, Limes Place, Limes Road, Croydon, the Model 100 pump for kerosine, diesel, and fuel oils can be supplied in either mobile or static form. The dimensions of the unit are 24 in high × 24 in wide × 12 in deep, and the weight is approximately 160 lb. A rubber hose is supplied fitted with a swivel coupling, and the quick-action nozzle incorporates a check valve. The No 5 semi-rotary pump gives an output of 8–10 gal/min.

### Vapour Phase Process Chromatograph

The Quality Control Division of Elliot Brothers (London) Ltd is introducing the new C.E.C. vapour phase process chromatograph on to the British market. The chromatograph, Type 26-212, is designed for a very wide range of applications and is particularly suited for automatic closed loop control.

Special features include: a complete analysis of all hydrocarbons up to and including petenes achieved in 29 sec with an accuracy of 1 per cent of full scale; up to 8 streams can be automatically analysed in repetitive sequence; and its joint development with the Taylor Instrument Company's control system.

### "CONtorq" Variable Speed Reduction Unit

What is said to be an entirely new venture in the field of variable speed transmission is announced by Fairbairn Lawson Combe Barbour Ltd, PO Box 32, Leeds 1. The unit in question, the *CONtorq*, maintains accurately the selected speed by the complete absence of fluid or friction properties, regardless of changes in climatic conditions. It transmits constant torque throughout its entire speed range.

The standard unit operates from a constant input speed of 450 rev/min, giving an infinitely variable speed range on the output shaft of 0–50 rev/min. Speed changes which may be effected while the unit is in operation or stationary are made by the turn of a graduated dial. The unit is completely sealed and self-lubricating, and can be supplied with either right- or left-handed input and output shafts.

### Scientific Equipment Exhibition

From 12–14 July the Griffin and George Group of Companies, Ealing Road, Alperton, Wembley, Middlesex, held what is claimed to be one of the largest exhibitions of scientific equipment ever organized in the U.K. by one firm.

It comprised the latest equipment devised and developed by Griffin and George, and also that of over 20 of the manufacturers whose equipment is sold by Griffin and George (Sales) Ltd. Also, much interesting equipment from overseas was shown. A comprehensive range of appliances for the teaching of science was on view, together with all manner of equipment for industry and research, and laboratory furniture and apparatus.

In the field of gas chromatography, items of apparatus on show were the Turner dielectric monitor for liquid phase and partition chromatography, the Griffin absorption chromatograph for gas analysis using carbon dioxide as a carrier, and the Griffin gas density ratio monitor, for analysis for control purposes of two component gas streams.

### Plastic Tower Packing Rights

The Hydronyl Syndicate Ltd has acquired from Saro Products Ltd the sole right of supplying in the U.K. and the Benelux countries Dowpac, the plastic tower packing developed by the Dow Chemical Company, U.S.A. Enquiries particularly in connexion with trade effluents, sewage treatment, and water cooling, should be addressed to The Hydronyl Syndicate, 14 Gloucester Road, London, S.W.7.

### New Engineering Agents and Consultants

A new company, K. A. Ballard Ltd, has been formed to act as engineering agents and consultants, with emphasis on the petroleum, petrochemical, and chemical industries.

The field of activity will embrace general fabrication for the movement and storage of fluids in these industries, including pipes, pipelines, fittings, valves, pumps, and road tankers. The company is operating from Woodthorpe, Church Road, Worcester Park, Surrey.

### Smiths Industrial Division

The board of S. Smith and Sons (England) Ltd has formed a new division to integrate its business in industrial products, which have hitherto been made or marketed by Smiths Industrial Instruments Ltd, Kelvin & Hughes (Industrial) Ltd, and David Harcourt Ltd. The undertaking so transferred, together with the appropriate manufacturing activities of the parent company, will then be formally established as the Industrial Division of S. Smith and Sons (England) Ltd.

### Solartron Companies Move to Chessington

The first step in the programmed removal of Solartron Laboratory Instruments Ltd, and other Solartron departments located at Thames Ditton, to new premises has begun.

The departments dealing with U.K. instrument sales, instrument service and despatch, and the Exports Division of the Solartron Electronic Group Ltd, have therefore changed their addresses to Cox Lane, Chessington, Surrey.

### Data Processing Service for Industry

De Havilland Propellers Ltd has set up at its Stevenage factory, an organization which can perform data processing on a commercial basis. Raw data from strip chart records on film or paper can be accurately transferred on to standard punched cards, punched paper tape, or into tables. The punched cards or tape may then be fed into a suitable computer elsewhere. Alternatively, if the information is presented on punched cards or tape, it can be automatically displayed, up to 6 variables being plotted together on a common base scale.

This service should be of particular interest to those already using punched card or punched tape systems, who require batches of information to be transposed quickly and at low cost without having to install and operate complex equipment.

### Manual Welding Equipment

Up to 12 lb of metal deposited per hour is claimed for the Philips manual CO- welding equipment, which is at least three times the accepted rate of deposition by an efficient welder using conventional electrodes. It is also stated that all-positional welding is practicable using conventional DC power sources. Overhead, vertical up, vertical down, and downhead welding can all be done in sequence without change of current and voltage.

The equipment is marketed in the U.K. by Research and Control Instruments Ltd, Instrument House, 207 King's Cross Road, London, W.C.1.

### Electro-Polishing for Stainless Steel

A new method of electro-polishing large articles of stainless steel has been introduced by Electropol Processing Ltd, Trading Estate, Farnham, Surrey.

It is the reverse of electro-plating, in that a film of metal of 0·001–0·005 in is removed, leaving a polished surface. An electrochemical process, it is said to be considerably cheaper than mechanical methods. Articles can be processed in tanks of up to 3000 gal and over in capacity, and the process increases the articles' corrosion resistance.

### New Constant Flow Valve

A new constant flow valve manufactured by Black Automatic Controls Ltd of Corsham, Wilts, automatically maintains a constant rate of fluid flow irrespective of variations in the supply or delivery pressures. Designed in the first place to control the flow of fuel oil and creosote pitch to open hearth and other oil-fired furnaces, it may be used with all kinds of oil-burning appliances where a constant flow rate is essential.

There are two standard sizes: a maximum capacity of 600 Imp gal hr with intermediate ranges from 100 Imp gal hr upwards; and another with a maximum capacity of 120 Imp gal hr and a minimum range of 5 Imp gal hr.

### Portable Arc Welding Transformer

The *Fararc* 240, the latest version of the *Fararc* toroidal welding transformer, incorporates a new system of insulation that allows the set to be used for more continuous use on heavier gauge rod without overheating. This is achieved by a new process whereby the two primary and the secondary windings are independently impregnated and baked. Open circuit voltage is 50 V, and the current range is 60–300 A with a continuous rating of 200 A.

Further details can be obtained from Portable Welders Ltd, Castle Mills, Buckingham, Bucks.

### New Range of Simple Scanners

Filling the gap between the electronic strip chart recorder and complex data handling systems, a range of simple scanners is announced by Honeywell Controls Ltd.

The new units will scan process variables at either 2 or 7 points a second, and are ideal for process industries where permanent records are not required and only off-normal points are of interest. Known as types B, C, and D, the units use the principle of comparing incoming voltage against a pre-set alarm level, in a non-indicating device called a blind amplifier.

### Perkins' New Branch

Perkins Engines Ltd, Peterborough, has set up a parts merchandizing branch within its service department. Manager of the new branch is G. H. Yarnold, formerly export service manager, who will be responsible for the world-wide parts merchandizing operations of the company, and will operate through the present sales and service outlets.

# Forthcoming Meetings

### THE INSTITUTE

*(At 61 New Cavendish Street, London, W.1, 5.30 p.m.—tea 5 p.m.)*

**Applied Petroleum Research on a Vehicle Dynamometer.** J. Tubman, A.M.I.Mech.E., and J. F. Manger. **2 November**

### IP FAWLEY BRANCH

*(At Esso (Fawley) Recreation Club, Holbury, 7.30 p.m.)*

**Oil and Steel: Part I—Lubricants; Part II—Fuel Oil.** M. H. W. Gall, A.M.I.Mech.E., A.M.I.Plant.E., and R. J. Baldry, A.Inst.Fuel. **2 November**

### IP LONDON BRANCH

*(At 61 New Cavendish Street, London, W.1, 6 p.m.—tea 5.30 p.m.)*

**As Others See Us.** A. W. Deller, D.F.C. **26 October**

### IP NORTHERN BRANCH

*(At Engineers' Club, Albert Square, Manchester 2, 6.30 p.m.)*

**Bulk Transportation of Petroleum.** G. A. Parry. **18 October**

### IP SCOTTISH BRANCH

*(At BP Refinery Recreation Hall, Grangemouth, 7.30 p.m.)*

**The Mode of Action of TEL as an Anti-Knock Compound in Petrol Engines.** Prof. A. D. Walsh, M.A., Ph.D. **10 November**

### IP SOUTH WALES BRANCH

*(At the Training Centre, BP Refinery (Llandarcy) Ltd, 5.30 p.m.)*

**The Mechanization of the Postal Services.** C. T. Lamping, A.M.I.E.E. **20 October**

### IP STANLOW BRANCH

*(At Lecture Theatre, Grosvenor Museum, Chester, 7.30 p.m.)*

**Motor Gasoline — Road Testing.** J. G. Sharp, B.Sc. (Eng), A.M.I.Mech.E., A.F.R.Ae.S. **19 October**

### IP YORKSHIRE BRANCH

*(At Great Northern Hotel, Leeds, 7 p.m.)*

**Trackways to Motorways.** R. P. Bell. **12 October**

**Testing of Materials in Automobile Production.** J. E. James. **9 November**

### THE SOCIETY OF INSTRUMENT TECHNOLOGY

*(At Manson House, 26 Portland Place, London, W.1, 6.30 p.m.)*

**Transistor Switches in Monitor and Control Systems.** W. A. Ross. **13 October**

**Instrumentation Past, Present, and Future.** L. S. Yoxall. **25 October**

*(At the Leapark Hotel, Grangemouth, 7 p.m.)*

**Analytical Instruments for Process Control.** Dr. D. G. Stevenson, M.Sc. **20 October**

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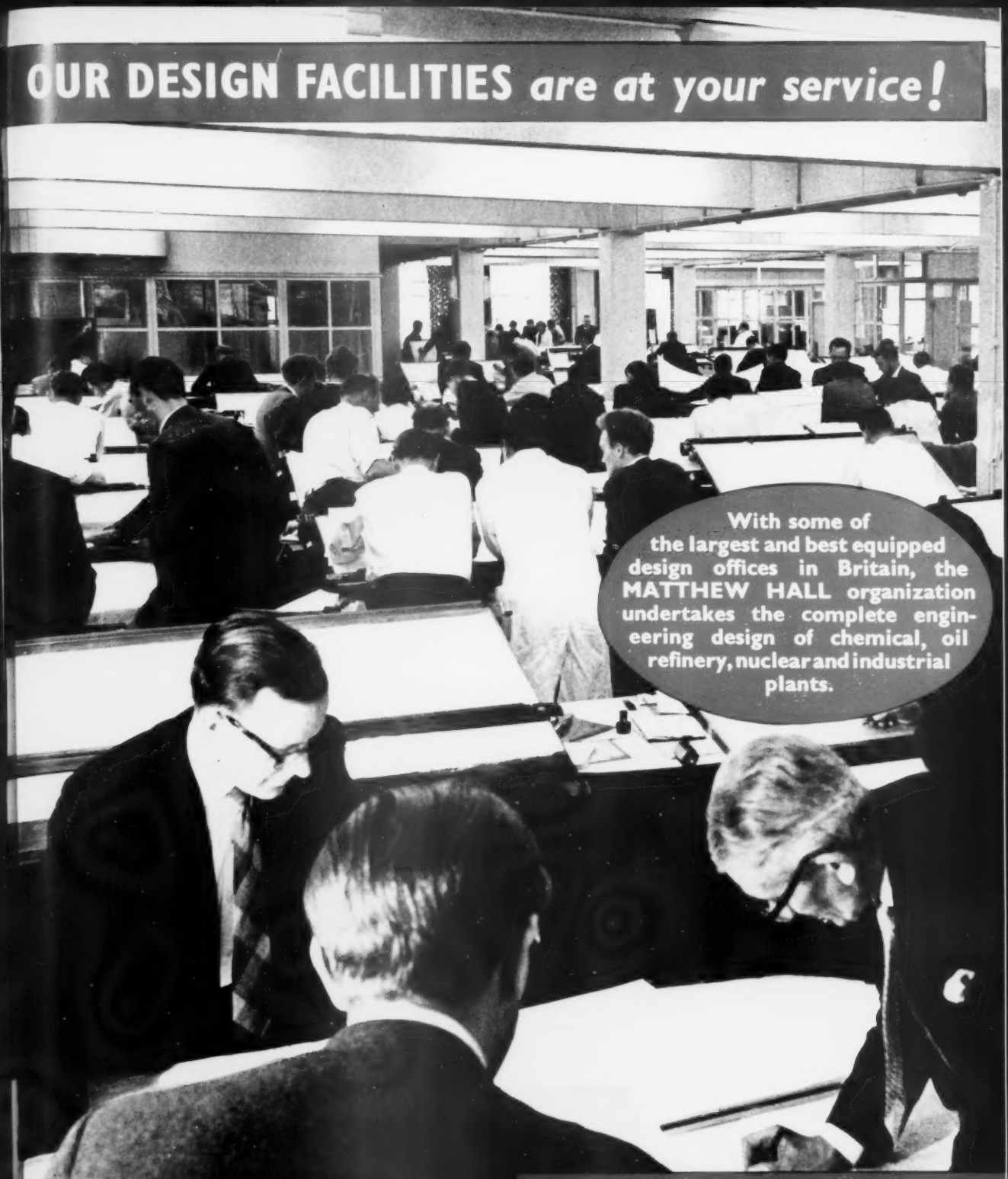

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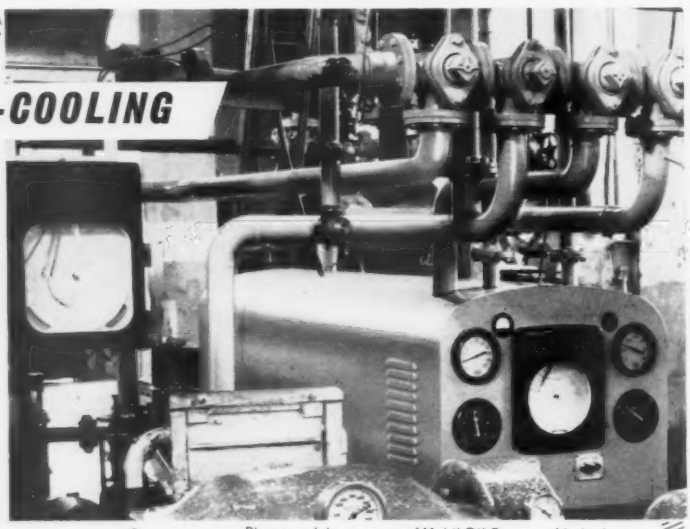

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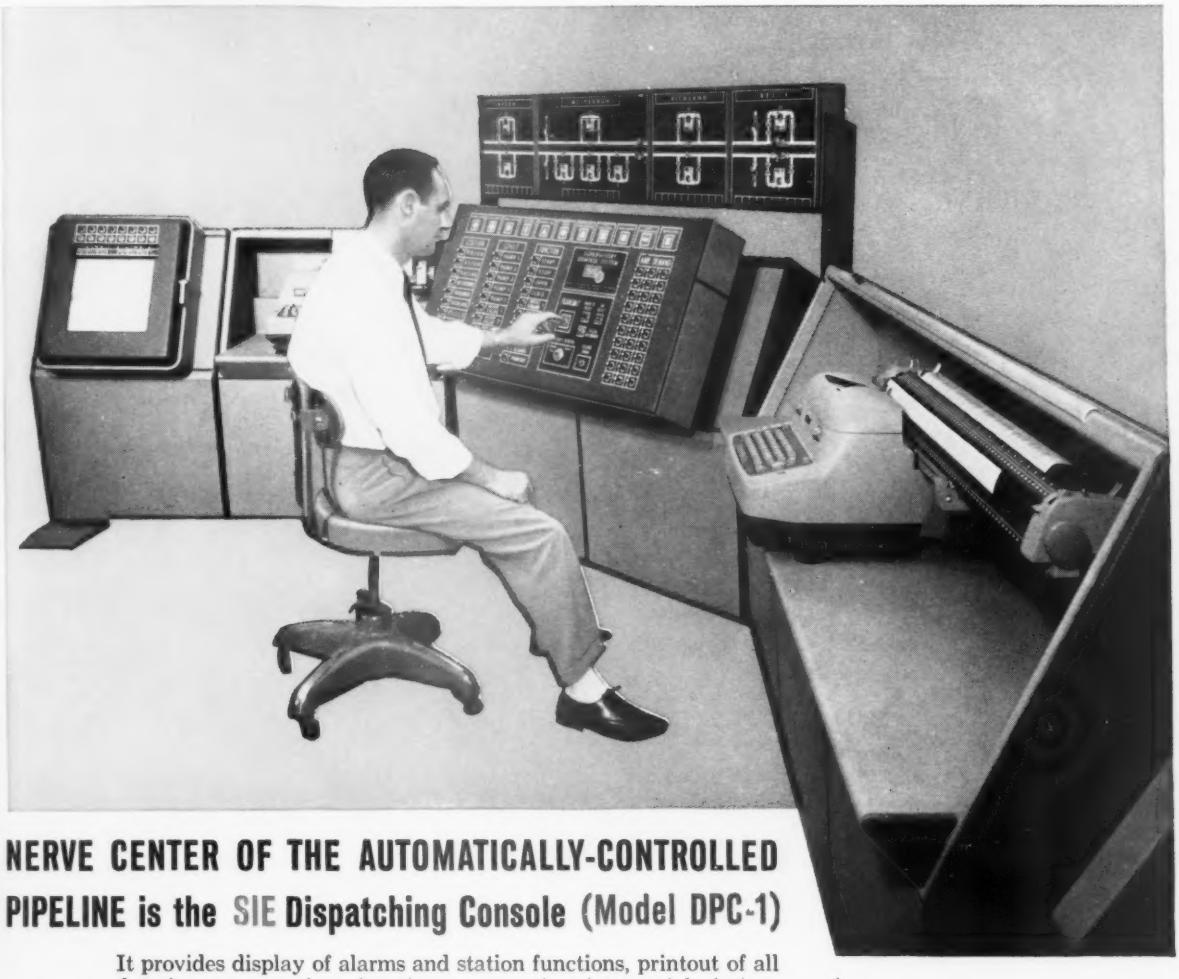

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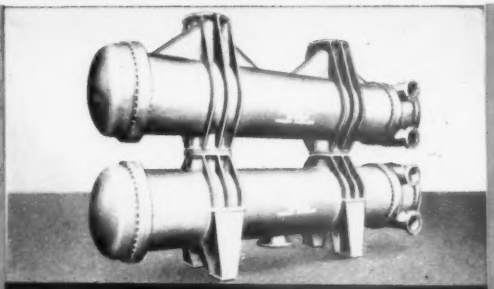

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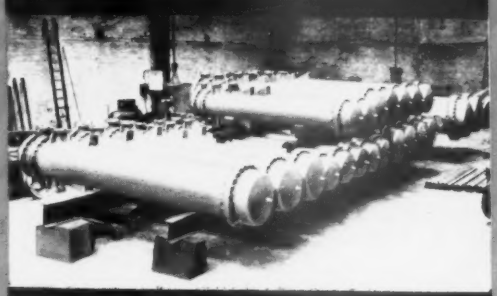

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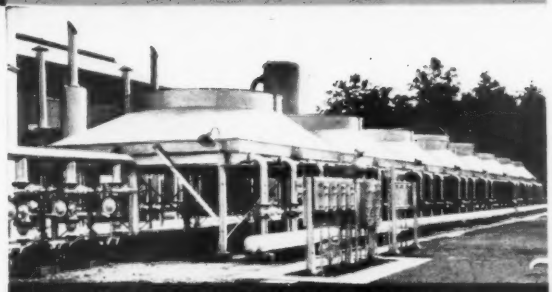
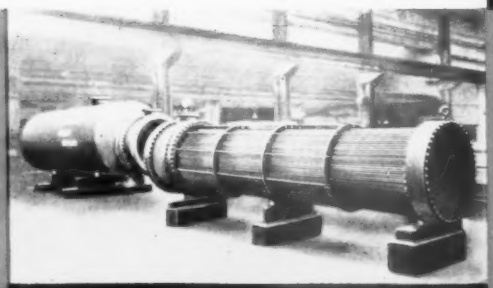
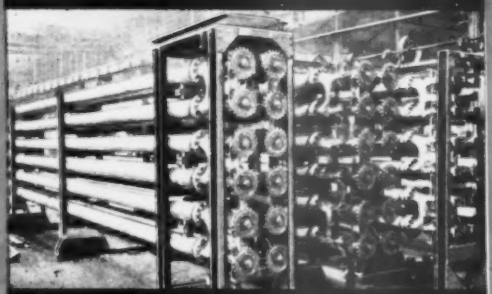


Craig-Hudson Solo-Air Exchangers -induced draught



Reboiler Shell and Tube Bundle



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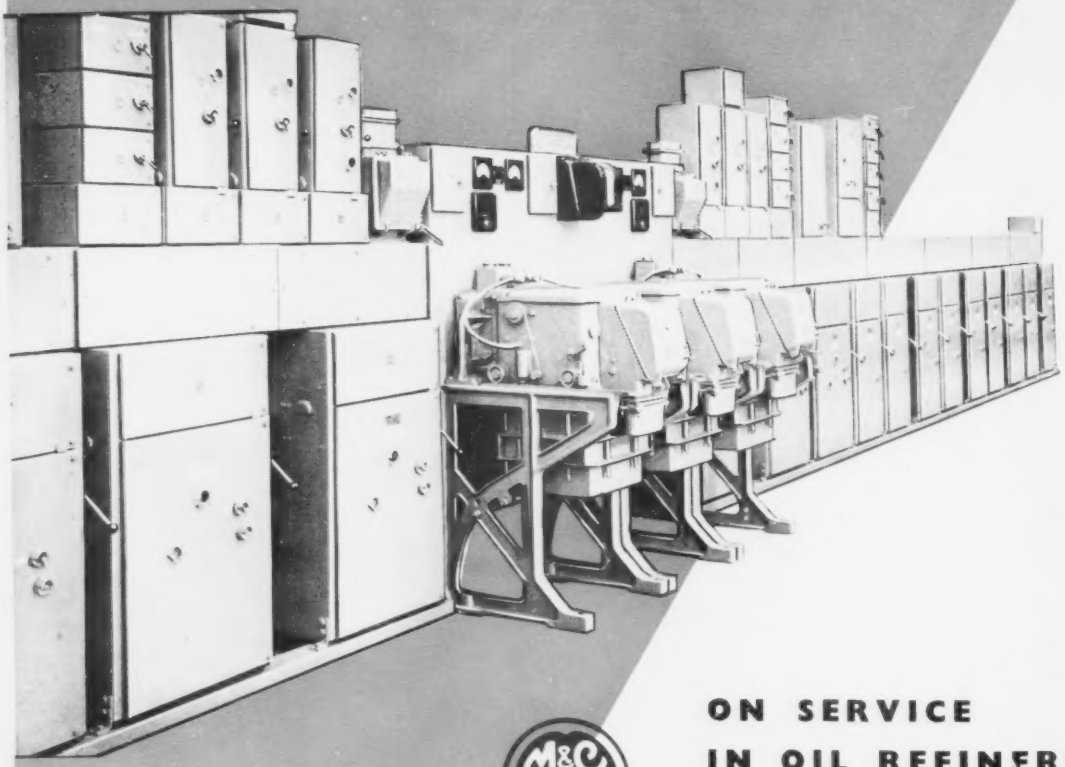
# Unit Type Motor Starters



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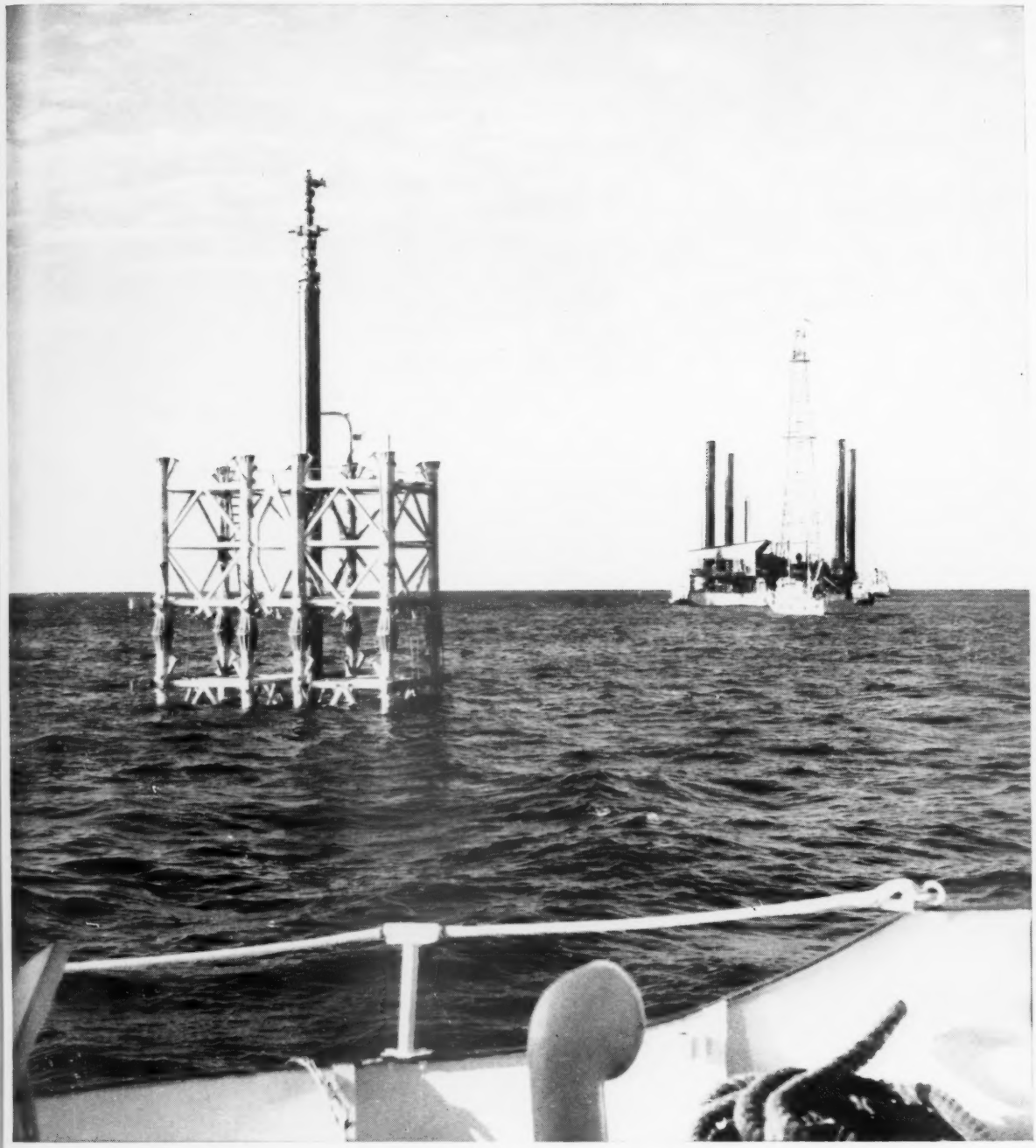

*ABU DHABI*

*A well head in the Persian Gulf. In the background, the barge "Adma Enterprise" which is currently drilling beneath the waters of the Gulf. The results are sufficiently encouraging to warrant the preparation of facilities for regular production. This stage should be reached by mid-1962.*

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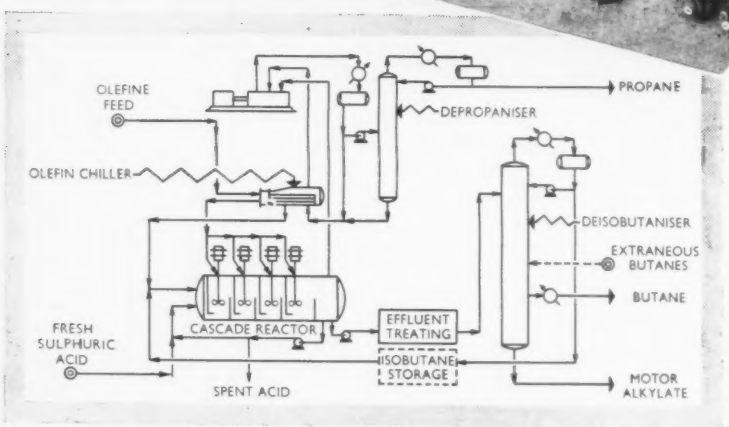


## Sulfuric Acid Alkylation

The olefin feed is chilled and split into parallel streams and fed to separate reaction zones in the Cascade Reactor.
Vaporization in each zone removes the heat of reaction and economically maintains low temperatures by auto-refrigeration.
Condensed refrigerant is depropanized and mixed with recycle isobutane and acid catalyst. This mixture flows in series through the reaction zones. The affect is of many reactors, each receiving the total recycle plus refrigerant isobutane (used to aid the reaction and to provide refrigeration).
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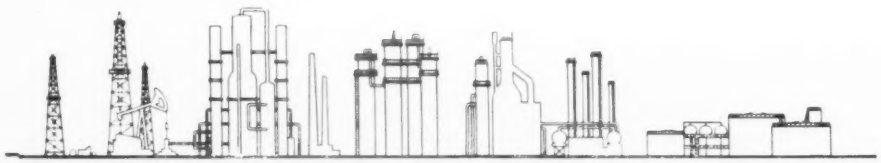

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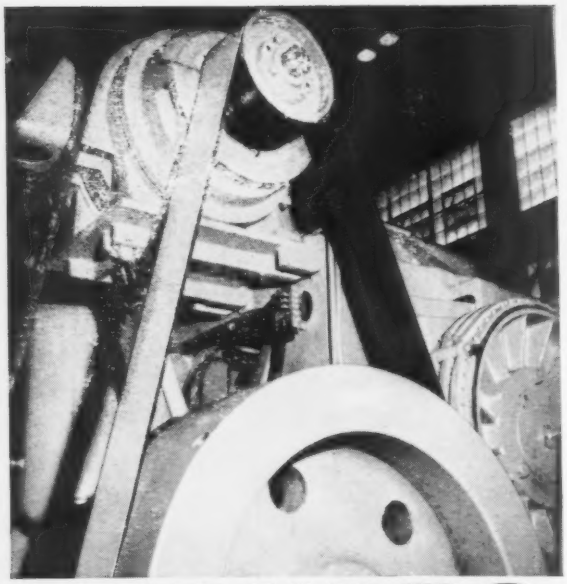

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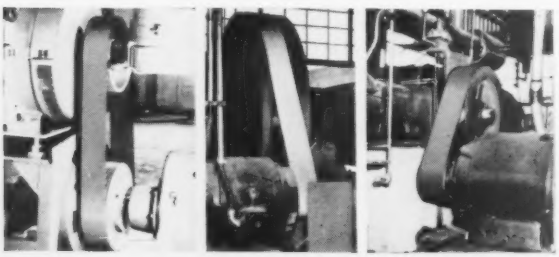

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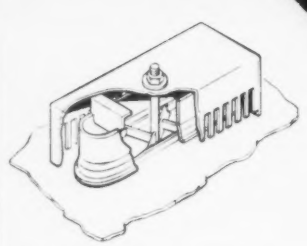

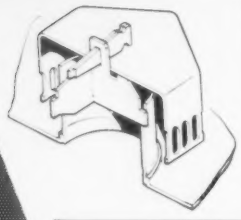

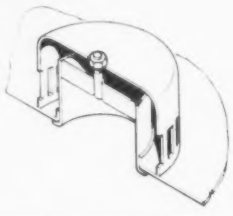

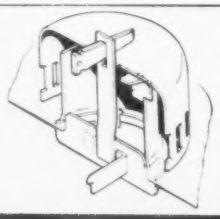

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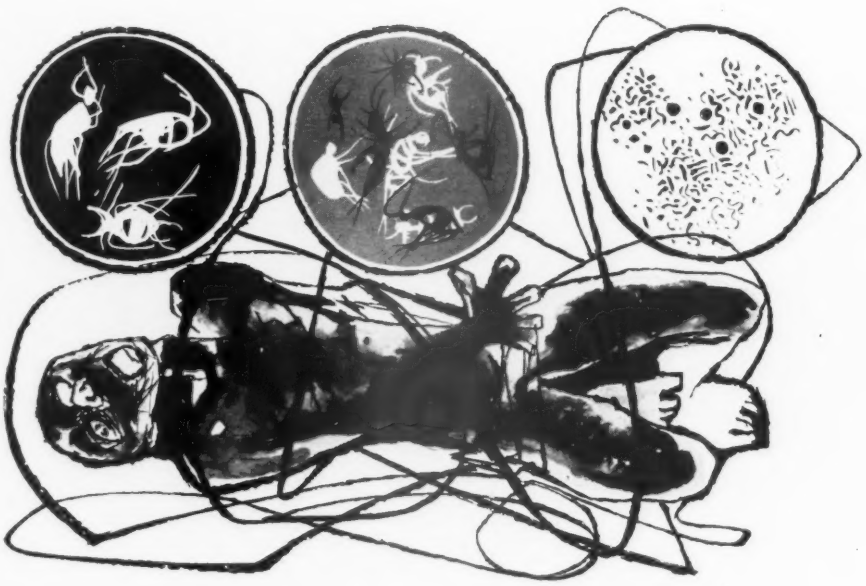

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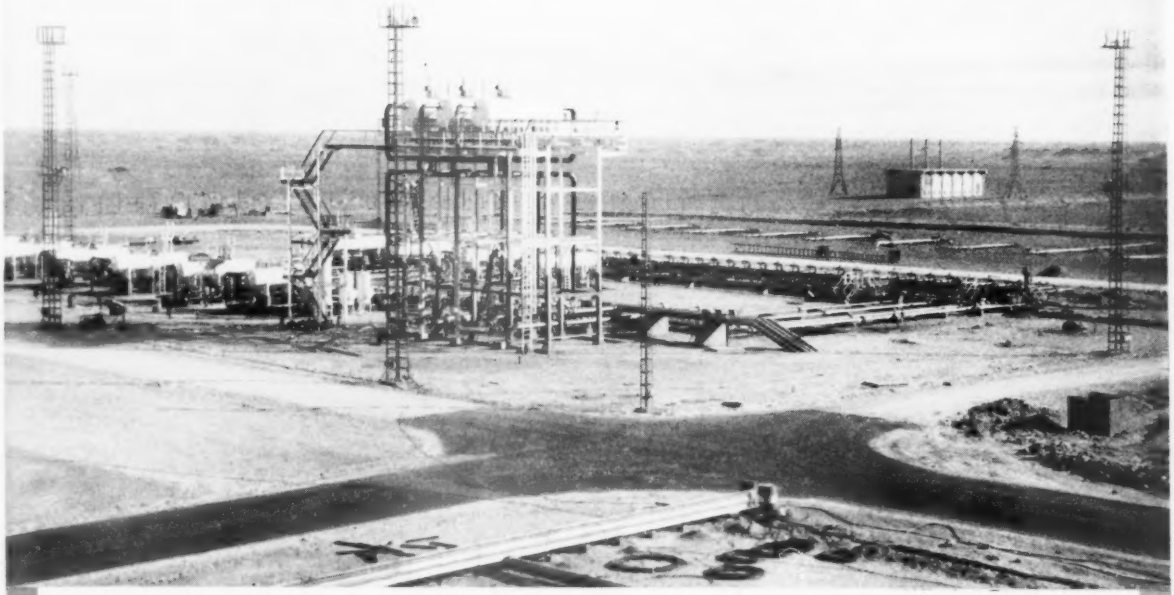

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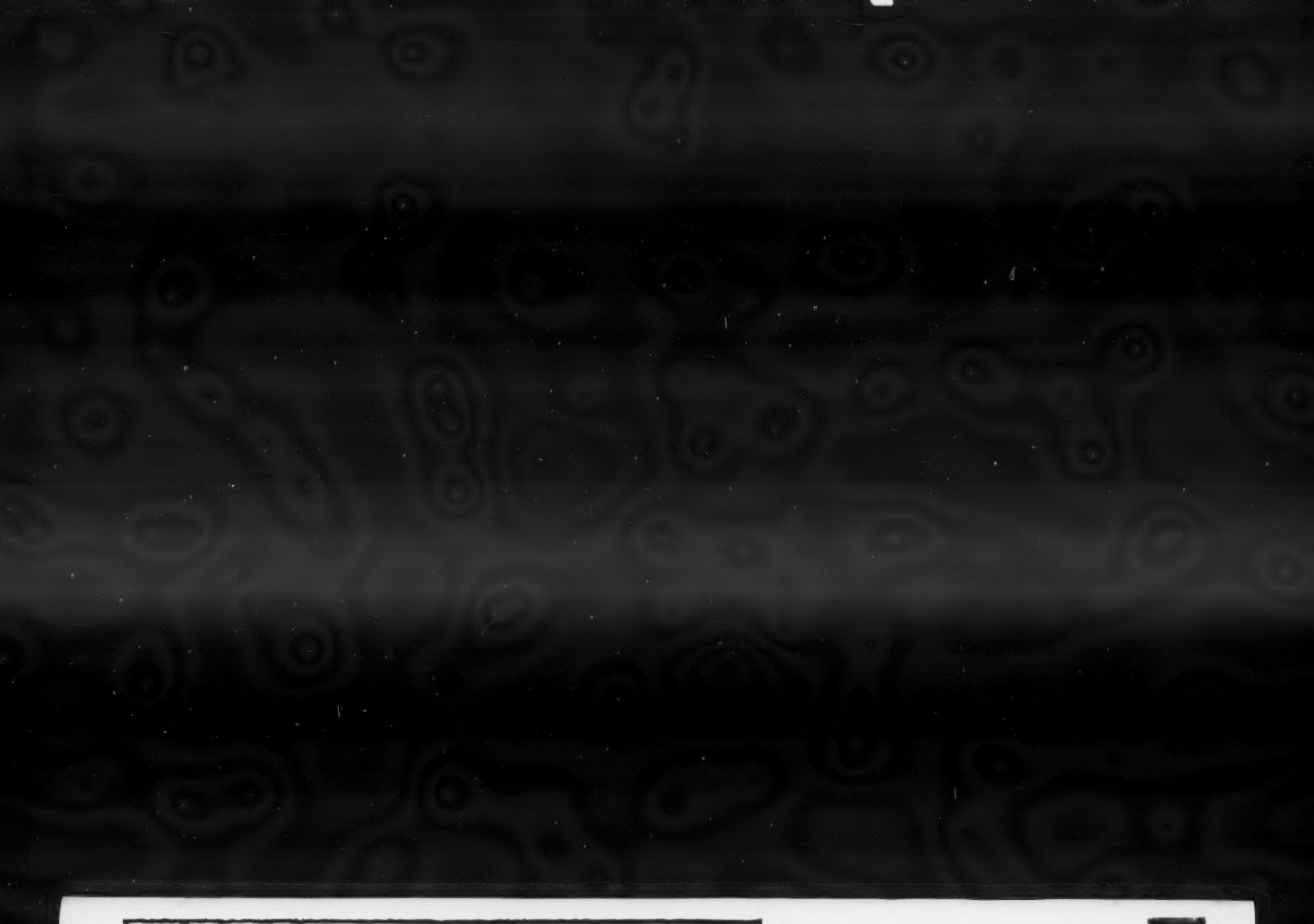
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